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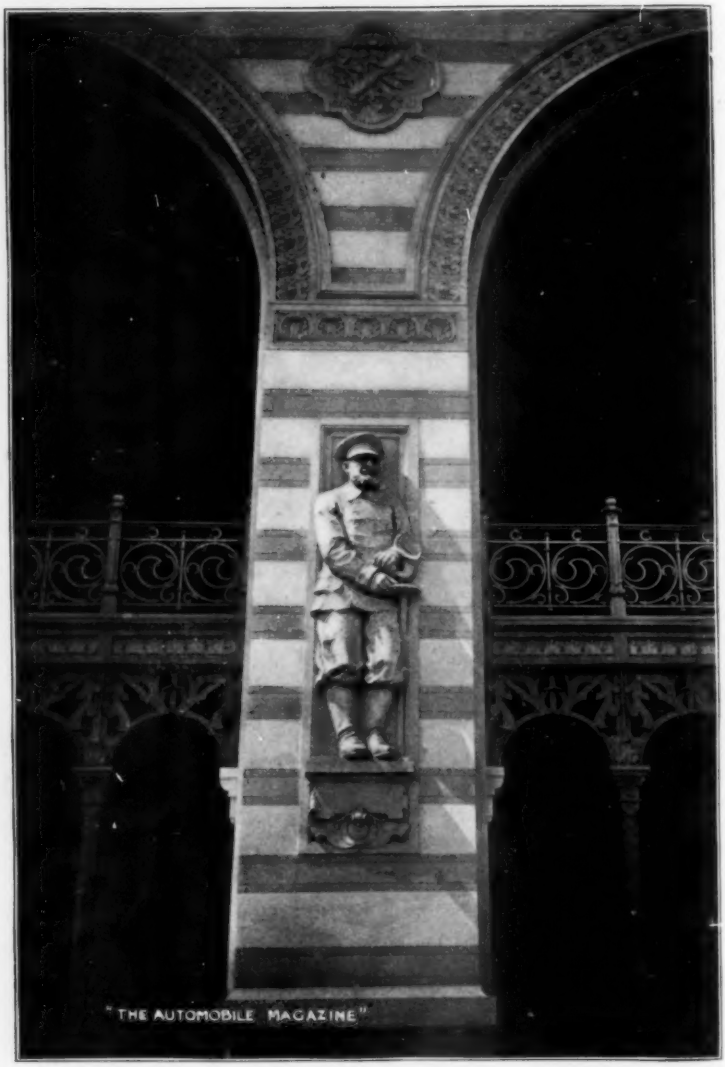


"The Automobilist"
Sculpture on the Transportation Palace
Paris Exposition

The Automobile MAGAZINE

VOL. II AUGUST 1900 NO. 5

The Automobile Section of the Paris Exposition

UNDER the auspices of the Automobile Club de France, expositions have been held in Paris from time to time, which were attended by crowds of enthusiastic *chauffeurs*. Admirable as these expositions undoubtedly were, they were defective in at least one respect—they were national, not international affairs. The automobiles exhibited at the Tuileries have been chiefly of French manufacture; few, indeed, were the vehicles which came from the shops of foreign makers. With the French carriages the *chauffeurs* were thoroughly familiar; for automobiles from every factory in France can be seen on the avenues and streets of Paris. And for that reason the *chauffeur* visited the Tuileries largely as a matter of automobile piety; automobilism was a new sport, an interesting sport, a sport that promised much, and for that reason deserved to be encouraged.

But when the Transportation and Civil Engineering Palace of the 1900 Exposition at Paris was officially opened, automobilists flocked thither with something more than the feeling of a solemn duty to be performed; for they knew that, for the first time, they would have an opportunity of inspecting the automobiles of all countries, gathered under one huge roof, and conveniently classified and arranged for examination. French vehicles were placed side by side with those of foreign make, so that the *chauffeur* could see for himself wherein French carriages differed from German, English and American vehicles; wherein they were stronger, wherein weaker.

The Americans who visited the Transportation Palace had no reason to be ashamed of the exhibit made by their countrymen.

General View of the Automobile Exhibit
Paris Exposition, 1900

Automobile Section of the Paris Exposition

Perhaps the most comprehensive exhibit is that of the Electric Vehicle Company, of New York City; for it includes vehicles of almost every kind—broughams, phaetons, runabouts, light delivery wagons, omnibuses, ambulances, and the like. Another interesting exhibit was that of the Locomobile Company of America, with its handsome steam-carriage placed beneath the white, pillared architecture so familiar to Americans.

But the exposition of automobiles in itself is by no means the most interesting feature of the Transportation Palace. The indefatigable Forestier, Chairman of the Automobile Committee,

United States Section of Transportation Building
United States Automobile Department, Paris Exposition

has instituted most interesting competitions, which have attracted considerable attention. Of these competitions, the most recent was a motocycle contest.

Little, indeed, can be judged of the merits of an automobile from external appearance alone. A good automobile is judged by its durability of construction, by its simplicity of design, by its consumption of fuel, by its speed, and by a hundred other factors. In a *concours,* in which a schedule is carefully arranged for each vehicle, in which every circumstance is carefully noted, in which the strains and stresses are as minutely calculated as the con-

Friezes on the Transportation Building, Showing Last Century Transportation and Automobile Race
Paris Exposition, 1900

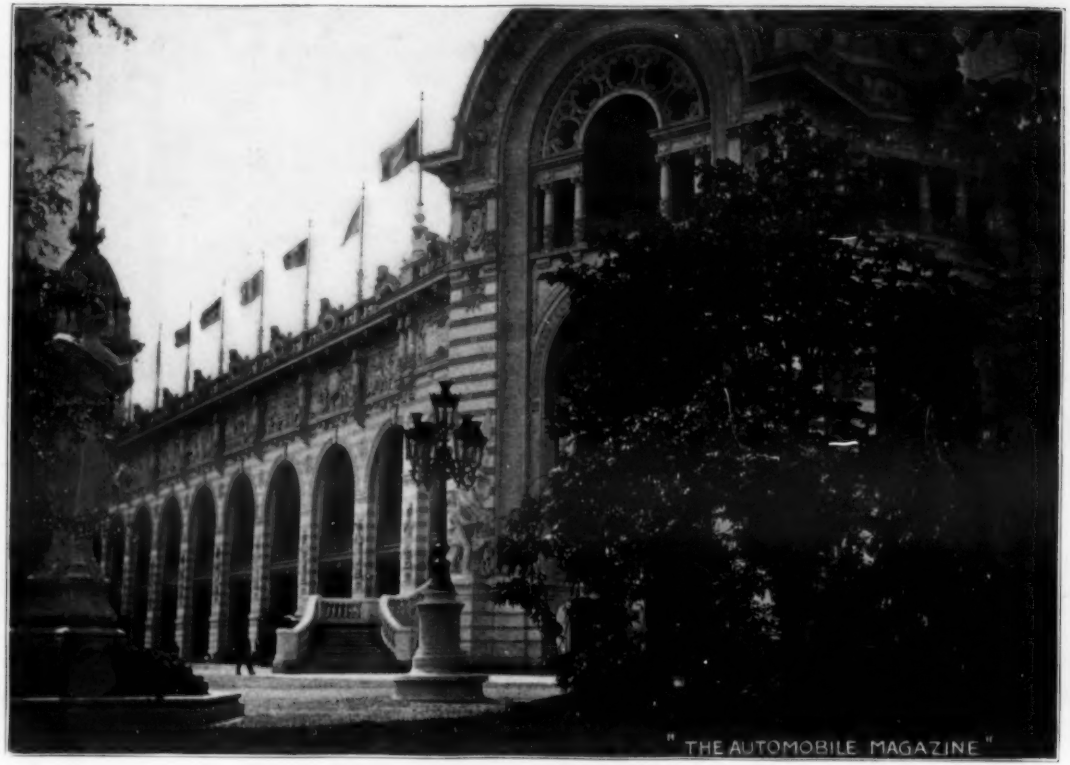
sumption of fuel, facts are ascertained which count for more than mere elegance of appearance.

Such a *concours* was the motocycle contest to which we have referred. The little cycles were made to run 160 kilometres (99.36 miles) around Lake Daumesnil, under the conditions we have described. When the verdict of the committee of judges will be published, we have no doubt that much will be added to our knowledge of the efficiency of the motocycles of various makers—much that will enable us to compare our own product

Exhibit of the Electric Vehicle Company of New York
Paris Exposition

with that of French manufacturers. Automobile makers themselves will profit by such contests; for they will ascertain where their vehicles are weak, and how that weakness can be remedied; and they will be able to place before their patrons the results of comparative tests which have proven what their product will stand.

The interest aroused by Forestier's *concours* at Vincennes was exceeded only by that excited by the ever-memorable race for the Gordon Bennett Cup—a race which *chauffeurs* on both

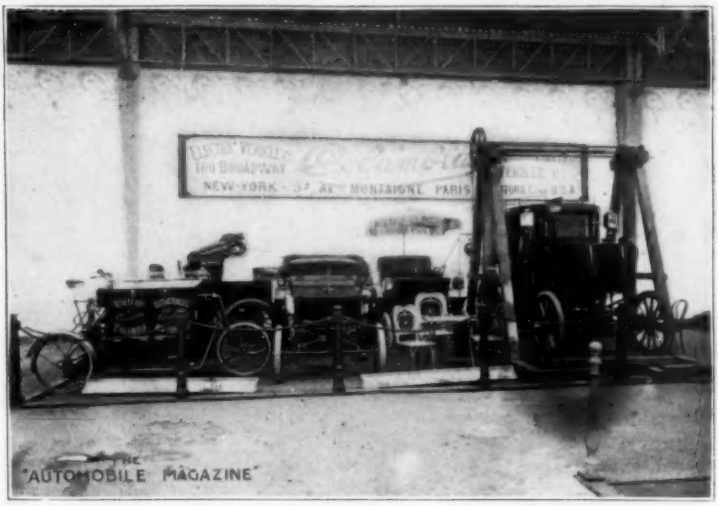


Transportation and Civil Engineering Palace
Automobile Exposition, Paris, 1900

Automobile Section of the Paris Exposition

sides of the Atlantic have not yet ceased to discuss. Since the publication of our description of the race in last month's issue of the AUTOMOBILE MAGAZINE additional information has been received which will assuredly be of interest to every American automobilist.

As every one knows, the course was 566 kilometres (351.486 miles) long, which Charron, the winner of the race, covered in 9 hours and 9 minutes. Besides Charron, the American representative, Winton; the Belgian *chauffeur,* Jenatzy, and the French automobilists, de Knyff and Girardot, started at the signal



Part of Exhibit of the Electric Vehicle Company of New York
Paris Exposition

given by M. de Chasseloup-Laubat. The German representative, Herr Eugen, who might have been a formidable contestant, did not start, owing to the fact that he was unprepared. Mr. Winton had, probably, a hope of winning the race. The Belgian, on the other hand, indulged in no dreams; he had entered merely as a matter of form, with "any kind" of a carriage, as he said. He used a fairly good racing-machine, however.

As we narrated in our last issue, Mr. Winton's vehicle was crippled early in the race; his front wheel was bent and rear tire punctured. René de Knyff's fourth speed broke, and Jenatzy

practically abandoned the race after a series of minor accidents. Charron and Girardot were the only ones to finish. Charron had expected to cover the distance in eight hours, which would have made his average speed nearly 44 miles an hour. Why he did not succeed in maintaining this high average speed he has admirably told in *Le Velo:*

"I occupied third place at the start," he says. "Before me were René de Knyff and Winton; de Knyff started off badly;

Automobile Ambulance
Exhibited by the Electric Vehicle Company of New York, Paris Exposition

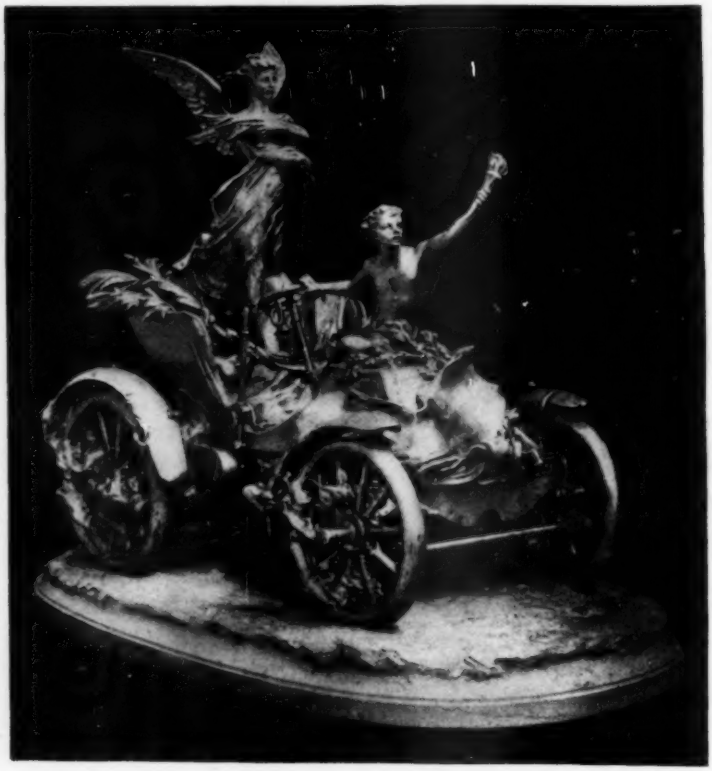
Winton was left behind, while at my left, Girardot and Jenatzy dashed by like madmen. At the tunnel of Ville-d'Avray I heard Winton tearing along behind me, and when nearing Picardie I saw Girardot and Jenatzy about 100 yards in front of me. It was not until I had reached a point between Versailles and Chevreuse that I overhauled Jenatzy. I steered cautiously and passed him at a speed of about 37 miles an hour. I smelt something burning. I looked at my tires; nothing was the matter

with them; but in front of me, Jenatzy had punctured his two rear tires. Girardot alone was left before me. I perceived that one of our carbureter plugs had been lost and that the motor was working poorly. Fournier repaired the carbureter, and soon after having passed Chartres we caught up to Girardot, who was running along less speedily. We made that kilometre (0.621 miles) in 37 seconds. Soon after one of the air tubes of our

The *Locomobile* Company of America at the Paris Exposition

front tires was torn out of its place—the only accident which happened to our tires. Six or seven minutes were consumed in repairing the injury, and Girardot passed on. I saw him no more, although I finished first. Everything went smoothly. We caught sight of Chateandun and were winding along toward Orleans, when suddenly we whipped up our speed to 55 miles an hour. Then full speed we dashed into a gutter. I do not know

how we ever got on our feet. Descending from the carriage, I saw that my rear axle was bent literally into a V. * * * I became frightened and I began slowly to walk to Orleans, in order to tell de Knyff, who would soon follow: 'I am out of the race. If I had seen that gutter nothing would have happened; but now I can do nothing; my axle is bent down to the ground.



The Gordon Bennett International Trophy

My chains cannot run properly.' But I saw nothing of de Knyff at Orleans. I saw only Chasseloup-Laubat, who said: 'Courage! You are the first.'

'First! And Girardot?

'I have not seen him!

'Where can he be?'

Automobile Section of the Paris Exposition

M. Charron

"Nothing to be heard of Girardot or de Knyff I once more determined to enter the struggle. Chasseloup said the axle would not break; so we went on. And we started without news of the airy Girardot, and we passed through towns without recognizing them. * * * Then we caught up to Levegh and Huillier, who assisted us in replenishing our oil-tank. It was at Moulins, Levegh told us; we had still 10 kilometres (6 miles) to travel before reaching Lyons. * * * The road was fine and straight. A group of motocyclists and a voiturette appeared before us. Suddenly a gigantic dog sprang out of the group, barred the road twenty yards before me. He was caught in the steering gear, between the wheel and the supporting spring. The carriage leaped to the left, passed between two trees, jumped a ditch, and returned to the road, I know not how. Nothing was damaged except the pump, and Fournier held that until we won."

The race, as even the French automobile press admits, by no means proves that French carriages are the best. But the race did prove that a man risks his life in such contests. And it also proved that at least three vehicles should be in line in case of an emergency.

The speeds attained were remarkable — so remarkable that the Automobile Club of America will do well to bear them in mind before challenging.

M. Girardot

The Buffalo Automobile Club

BUFFALO'S first automobile association perfected its organization at a meeting held at the Buffalo Club July 2. It is known as the Buffalo Automobile Club. The officers who were chosen to serve for the first year are: Dr. V. Mott Pierce, President; Dr. Truman J. Martin, Vice-President; George S. Metcalfe, Secretary; Dr. Lee H. Smith, Treasurer; D. W. Sowers, Consulting Engineer; Charles J. Shepard, J. T. Budd and Charles R. Huntley, Directors. The Directors and the officers will form the Board of Governors.

The permanent club headquarters will be the Colonial parlors at The Genesee. That hotel will be the assembling place for the club runs and the business of the club will be transacted in the parlors. The regular meetings will be held on the first Monday of each month. The annual meeting will be on the second Monday in October.

Four classes of membership will be included in the club. There will be honorary members, life members, active members and associate members. The honorary members thus far chosen are Mayor Diehl, Supt. Bull of the Police Department, and Chairman Healy of the Board of Public Works. The associate membership will consist of automobilists living outside of a radius of 50 miles from City Hall. There is at present an active membership of 34. The initiation fee is $20; the annual dues are $10.

Plans for club runs will soon be made. In anticipation of an early run, the Buffalo Yacht Club extended the use of its clubhouse at the foot of Porter avenue to the Automobile Club until July 14 as an assembling place. At the meeting a vote of thanks was adopted, but it was decided not to take advantage of the invitation in view of the selection of permanent club headquarters.

Each year the club will have an automobile parade. It is planned to have the first one on September 15, by which time it is expected the club will have a large membership and will have many vehicles for the turnout.

The establishment of storage stations about the city and in the country for the purpose of recharging vehicles whose batteries have become exhausted in the course of a run, and of furnishing other supplies, is a project that will be attended to as soon as possible.

How Cupid Stole an Auto

A Story of Newport Society

IT was the morning of the automobile parade at Newport, and Mr. Richard Carrington was nervous. He was out near the stables at his place, and was directing the efforts of a half dozen men who were busy decorating his motor carriage. A framework with a dome effect had already been built over the seat, and the men were busy with a mass of lilies of the valley and bride roses.

Mr. Carrington had long been a motorist, and in obstacle contests and road races had won many honors, but on this occasion he appeared to be very nervous for a man who owned a half dozen automobiles and who had lately returned from Paris, where he had done a lot of good hard work on the road.

Mr. Carrington, it must be confessed, was in love. The object of his affections lived in the adjoining place, and the only thing that separated him from the young woman was a thick hedge, an obdurate aunt and the young woman herself, who did not think very much of young Mr. Carrington's enterprise.

"If you really loved me," she had complained at a dance on the previous evening, "you would carry me off and marry me in spite of my aunt and in spite of myself."

Now, young Carrington, whose thoughts rarely soared above automobiles, did a lot of thinking, and incidentally invited the lady to ride with him in the parade. She hesitated a little, and then, taking into consideration the fact that her beloved aunt was out of town, accepted. Then young Carrington left the dance, did a lot of telephoning, and went to bed with the proud consciousness that things were likely to happen on the morrow.

He had arisen at an exceedingly early hour, and had started off at a fast pace in one of his auto carriages, and was not seen about Newport again until very late that morning. But he returned in a very happy mood, in spite of the fact that he was very nervous. He made a careful design for the decorations of his motor carriage, and was superintending the work himself, when from the other side of the hedge he heard his name called by a voice he well knew. It was the voice of Miss Jessica Carstairs, and she was already complaining a little.

"Have I got to ride in that cage?" she asked, with a glance at the automobile which was rapidly attaining the appearance of

a movable green-house. "Why, what are you making? It looks —it looks like a marriage bell—the kind they have at wedding receptions."

Young Carrington laughed and looked foolish. "Not at all, my dear. That is a design I took from a Japanese pagoda."

"It's very pretty, at all events," said Miss Jessica, who, by the way, was gowned all in white, and when, a few hours later, she took her seat in the carriage, her gown quite harmonized with the decorations.

"If that is a marriage bell," whispered Carrington to her, "you certainly look like a bride."

"My dear boy," said the young woman with dignity, "that is a subject which I refuse to further consider. You know you promised last night to say no more about it."

"True," said Carrington, carefully steering his auto between a butcher's wagon and a watering cart. "We'll let the matter drop, for the present, at least."

The meet was on Bellevue avenue, and it was a most remarkable collection of automobiles. They were decorated with flowers of all kinds, in all sorts of designs. One carriage was covered with flowers to represent a butterfly, with wide flapping wings on either side. Another had long fish-poles fore and aft covered with flowers, and the effect of the waving floral lines was like the antennæ of some huge insect.

As Carrington and his guest came up the line, society looked at one another and smiled. Yes; it was quite significant, and little Miss Carstairs sat under the marriage bell, with its bride roses and lilies of the valley, with a smile of contentment upon her face, and looked back at the old matrons, who flashed disapproval from their stern eyes, as if she didn't care at all.

Carrington was awarded the third place in the line, and everybody said that it was quite likely that he would get the prize for the most novel and best appearing vehicle. He accepted the congratulations of his friends with smiling serenity, and now that he had his auto completely decorated, and in the parade, and Miss Carstairs with him, he seemed to have lost his nervousness to some extent.

It looked as if the parade was to be a success from the very start. To be sure, one careless automobilist had lost control of a carriage and had demolished his lawn, and endeavored to run up the front steps of his residence; but the wandering vehicle had been captured by a half dozen attendants and had been turned around and was in its place when Mr. McAllister Duncan blew the whistle, which was the signal to start.

How Cupid Stole an Auto

It was a most imposing spectacle. Some of the carriages were completely buried beneath masses of roses and other flowers. The spokes in the wheels were twined with flowers, which gave them a most cumbrous effect. The women who sat in the carriages were the most beautiful ever seen at Newport, and in their light colored gowns, made to harmonize with the decorations of the carriages, they certainly made a brave sight.

The parade was led by Mr. Duncan, who had Mrs. Kensington Thompson with him. Then came Bertie Van der Vere, who had charge of Mrs. Aspinwall-Jones. Bertie, who was good at amateur theatricals, and who amused society in various ways at Newport, wore a most wonderful hat of straw made in the alpine fashion, and it only needed the addition of some ribbons and things to make it fit for any girl to wear; but Mr. Bertie didn't seem to be conscious of this, and his wide, smooth-shaven face beamed out upon the crowd with good nature and the proud consciousness of riding with the richest woman there. Bertie had visions of complimentary notices in the newspapers, and the sale of his roses and plants in which he dealt when in New York would no doubt be largely increased by this experience.

All went well, and society nodded and bowed from the automobiles to society less fortunate in their victorias and common carriages drawn by mere horses. The latter animals didn't seem to care for the parade very much, and some of them snorted and sniffed, as if they saw looming far ahead their future downfall, when every one would go about the streets in those strange vehicles, some of which went "Tef! Tef!" and which didn't seem to mind an all-day trip at all.

All went well until near the outskirts of Newport. The carriages were to wheel about a fountain in the centre of the street for the return trip. The two leading carriages went around all right, but something must have been the matter with young Carrington's machine, for it resolutely refused to make the turn. Instead, it seemed to leap ahead and was buzzing down the street, which led to the little Village of Middletown, at a most furious rate.

"Look at Carrington!" everybody cried. "What is the matter with him?"

"By the Lord Harry!" shouted Carrington to the amazed Bertie, who had turned safely in front of him without taking a wheel off anything. "I can't seem to stop this thing!"

And in an instant the automobile seemed to disappear down the road in a cloud of dust. Everybody was so amazed that they didn't know exactly what to do, and one or two of the men were

for following the runaway and offering Carrington their assistance, which he seemed to need so much. But Carrington didn't appear to be alarmed, and none of the flower-decked vehicles seemed to be in racing trim, so they let Carrington go, with the consoling thought that he would soon be able to shut off his power and return to town in time for the judging and the awarding of the beautiful silver cup which had been offered for the best appearing carriage.

"Why, Dick!" presently said Mr. Carrington's amazed guest, "what is the matter? Are we running away?" and a frightened look came into Miss Carstairs' usually tranquil eyes.

"I don't know," responded the young automobilist, beginning to fumble with the steering-gear and power-controller. "You know I can't seem to shut this thing off."

"Well, where are we going?" asked the young woman in dismay.

"I don't know," replied Carrington cheerfully. "This is rather nice, isn't it?"

They were speeding well into the country then, with green lawns on every side and here and there a country house in the distance, and with the bay dotted with white sails, and a clear road ahead. The automobile seemed to be making railroad speed, and after arousing a few stray dogs from their roadway siesta and frightening a brood of very young chickens half to death, settled down to what seemed a twenty-miles per hour gait.

"Is this a racing carriage?" inquired Miss Jessica presently, "or are you trying to see how long it will take to get to Boston?"

Now, Carrington had won more than one race with this carriage, both in this country and abroad, and he replied in this fashion:

"My dear child, I haven't had this carriage very long, so I don't know very much about it! But it goes all right, doesn't it?"

"Yes," was the reply rather dubiously. "But what will people say? I thought we were in a parade."

"We were, but events and circumstances over which I had no control took us out of it. Nothing short of a brick wall three feet thick or your esteemed aunt could stop this wagon now."

"Why, what do you mean, Dick?" inquired the maiden in alarm.

"Well," said Mr. Carrington, looking fondly at the blonde head which nestled near his own, and which upon more than one occasion had found a resting place on his shoulder. "You don't seem to like riding with me far away from everyone—but we are almost there——

"Almost where?" interrupted the young woman, who assumed the puzzled air which a woman only can successfully negotiate.

"A moment will explain all," said the crafty Dick, sagely, taking another pull at the power-controller and swinging by a handsome dog cart in the road at a terrific pace. In the carriage were two young men, who waved their hats and made some remarks, which were unintelligible owing to the speed at which the automobile passed.

"You see, my dear," continued Dick gently as the automobile settled down to a steady pace, "with your gracious permission you are going to get married. Time, high noon. Place, Old Oak Parsonage."

"What?" almost screamed the girl. "You would do a thing like that?"

"Now we'll talk sense," continued Dick with a fatherly air, highly pleased at the success of his endeavors. "It's all right," he added reassuringly. "Those fellows in the cart are my ushers. You see you are in my power this time. It's my turn now. You have been in the power of that family of yours long enough. With the help of my sturdy automobile I am going to marry you!"

"What have I got to say to this?" asked Miss Carstairs, eyes wide open, with mock amazement at Dick's sudden coming to life.

"Nothing at all," replied Dick cheerfully. "All you have to do is to be present and make the responses at the right time."

"I don't like it at all," declared Miss Carstairs, and there were symptoms of a coming storm of tears. "I wanted a big wedding, in a church, with lots of bridesmaids and flowers and—people—." She was searching about for something more to add when Dick exclaimed excitedly:

"Here we are! All out!" And he stopped the automobile in front of a quaint roadside cottage adjoining a little rustic church.

A fatherly looking old man, his face beaming with smiles, stood on the steps,with a hearty welcome for both, and when Dick and his bride entered the house all was confusion. By some miracle five of Miss Carstairs' best friends happened to be there, and several young men wandered about trying to look innocent, and they shook hands warmly with Dick and congratulated him upon his nerve.

The bride-elect had been taken away by the young women, and then a cry was heard outside, and everybody rushed to the door to see a string of carriages coming down the road, and in

the midst were one or two flower-laden automobiles which had taken part in the parade.

"Where's the wedding?" shouted Bertie Van der Vere, who was well in the van of the procession. "Are we too late? Dick, you rascal, did you suppose we would let you run away like that, especially after the judges had made up their minds to award you the prize for the best decorated machine?"

"I've won other prizes," commented Dick soberly.

Everybody got out, and under the leadership of Mr. Bertie they took the marriage bell of lilies of the valley and bride roses off the automobile and set it up in the drawing-room. Dick produced a marriage license in some mysterious way, and then good old Dr. Everitt had a little conference with the bride. And when the young woman saw the great gathering of her friends and the bridesmaids all there, she waived her objections for a conventional wedding and entered into the spirit of the occasion and said it would be best to go on with the ceremony after all.

And so they were married, and a wedding breakfast appeared in the most mysterious manner from somewhere, and Dick patted himself on the back for being so bright and doing such a lot of telephoning. And the young people wandered out on the lawn and inspected Dick's automobile, as if it were to blame for running away with the young couple.

And then they took the marriage bell out of the house and willing hands redecorated the automobile and tied white ribbons all about it, and two little white doves, which Mr. Bertie Van der Vere had thoughtfully provided. And the bridal couple started off up the road all alone, at a most dignified pace, towards Newport.

"We came down here at a rather fast pace," remarked the bride as they came to the place where Dick and his carriage had bolted from the parade. "I always supposed you knew how to handle an auto," she added, looking up at him with a happy little smile.

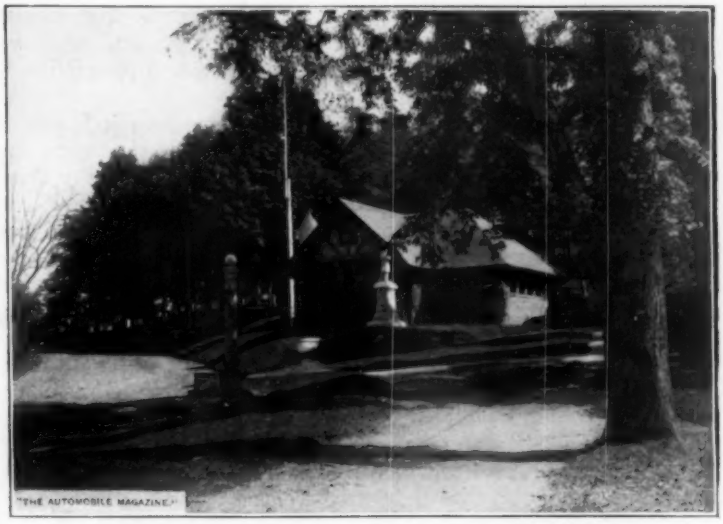
"I thought I did," declared Mr. Carrington stoutly. "But you never know exactly when those things will get away from you, and I am a pretty good motorist, too," he added reflectively.

"You are," she murmured softly.

Better Roads

An Argument for Improved Highways, with some Convincing Facts as to the Economic Value of Good Roads, and a Comparison of the Different Methods used in their Construction.

THE demand for good roads, so loud and constant during the last few years that the machinery of government all over the United States has been forced to heed it, has several phases which space did not permit us to cover in the



Huntington, Long Island

article on this subject written for us by Mr. Theodore Dreiser in the May number, says Mr. C. Arthur Pearson in *Pearson's Magazine* for July. The ignorance and indifference which permitted the loss of millions of dollars annually, and submitted to the constant hardships and annoyances caused by bad roads, have been replaced by a widespread recognition of the value of reliable highways, and by the most aggressive efforts to secure them. The fact that America has been notorious for its lack of great highways, and its vast network of crude and periodically impass-

able roads, is due primarily to the lack of knowledge by the masses of the people as to methods of making good roads and their vital necessity. The direct cause is found in the waste of public money collected for the benefit of highways. Sufficient sums have been appropriated and misspent, and there has been sufficient labor along *futile* lines in every State in the Union during the past century to have given this country the best roads in the world. And yet, barring the recent improvement in several States—an improvement which affects only about two per cent. of the road systems of the entire country—there are no good roads. There are plenty of fair-weather roads, good in dry seasons, but these in winter weather are anything but passable. In many States most of the farmers and residents of the smaller villages are completely isolated for periods varying from two to six weeks during the worst of the winter season. And yet among these very people has existed the greatest opposition to the expense of building a good highway.

Strange as this may seem on first appearances, it is not so strange when the general ignorance concerning the simple method of building and the modest cost that attaches to a mile of good road is taken into consideration. Farmers generally would like to have good roads, but they imagine that their presence means an intolerable burden of taxation. They do not stop to consider the intolerable tax they are paying in loss of opportunity for want of them. Thus the farmers of New Jersey did not discover what they had lost until a few model roads were built in their territory, when the truth concerning previous disadvantages became startlingly plain. In answer to a general inquiry sent out by the Chairman of the New Jersey State Board of Agriculture, as to whether the roads had worked an improvement in their conditions, hundreds of replies were received—all of them affirmations, and some so concise that they may well serve as illustrations of the value of the whole movement. One wrote:

"We are very proud of the country road in our neighborhood, so recently put in shape. Even before it was laid by the State property near it advanced nearly fifty per cent. in value. A case in point is that of a piece of property right here which could have been bought for $20,000 before the road was built, and only a few days ago the owner was offered $30,000 for the same farm, and it is two miles away from any railroad station. There are many more cases here of the same sort. We favor good roads."

Another wrote:

"Prior to 1897 I lived within two miles of a stone road leading to Camden. My tenant hauled manure from Philadelphia

during the fall and winter, going down with two horses and bringing out a load with them. When he got to within two miles of home he had to double up his teams in order to bring the two-horse load the balance of the distance to my farm. It took him longer and was more fatiguing to the team to come

Bridgehampton, Long Island

those two miles than to come the entire ten miles from Philadelphia to Merchantville, and he was frequently obliged to throw part of the load off in order to get home with the four horses. It is this waste of time which makes it important to farmers that we should have improved highways. I know it is necessary to

educate the people up to this idea of stone roads, and that it requires a great deal of education in some cases.

"Before the building of the turnpikes, 25 baskets of potatoes were considered a load from the farm I now occupy to market. After the turnpike was built 50 to 60 baskets were considered no more of a load than the 25 a few years previous. And now, since the stone road has been built, our load is 85 or 100 baskets; and during the past winter our team has carted over 150 loads of manure from Philadelphia, several of which I weighed and found to amount to 6,869, 7,300, and 7,920 pounds, clear of the wagon, which alone weighed 2,300 pounds, a combined weight of about four and a half tons. Many of these loads were drawn from the city to the point of leaving the stone road with only two horses, and the result has been the saving of over $100 in my manure bill for the year."

The last one, which may be selected for the present purpose, voices much the same thought in another way. This farmer replied:

"Good stone roads—and stone seems to be the only way of making roads permanently good—are of great importance and benefit to us farmers. To make any profits we must haul heavy loads. With the taxes I pay it is but just that I be able to go to and from town with as great a load as my team can haul through town, without having to use four extra horses to insure getting through the sand. We ought to be able to work our teams all the year round, instead of having to keep idle while the frost comes out of the ground."

The average farmer out West has to haul his product and supplies about five miles. His teams are good, but they haul on the average less than a ton—perhaps not more than three-fourths of a ton—a load. The time required to make the trip averages close upon three-fourths of a day. During hauling season wages are high, and the expense of the "short haul" from farm to station is made heavier than for the "long haul" that follows by rail or boat. The substantial improvement of the roads means that just twice as much can be hauled by any given number of horses in just half the time, and *that* at any period when horses are not needed on the farm—a thing which is never possible with a poor road. For this is the worst of the whole bad-road system, namely: that when it is good enough to haul over them, the farm is good enough to work on, and horses and wagons are needed there. When they are impassable, because of mud and water, the farm is also unworkable, and horses and wagons are idle. Thus a double injury is worked.

Better Roads

It has been figured by an expert of the government of Minnesota, that if only the worst places in all the roads of that commonwealth could be repaired (stretches of ruts and hollows which aggregate only a sixth of all the road mileage of the State), it would enable farmers to haul a third more of a load and to haul it at a third less time.

"This means," he says, "that where it now takes three-fourths of a day to haul thirty bushels of wheat or potatoes, forty bushels could be hauled just as easily in half a day, or eighty bushels a day, if necessary. It means that where it now

Westbury, Long Island

costs $3 to market three-fourths of a ton, it would then cost but $2 to market a ton—a saving of half the expense. It means the extension of the hauling system to suit the convenience of the farmer and an opportunity to take advantage of the market. As it stands now, the markets take advantage of him. It means a net saving of at least 10 per cent. of the value of his products. If he was making money before, it means double profits now; if he was running behind, it opens the way for him to retrieve his losses and get on in the world."

All this for the repair of one-sixth of the roads of a State, and yet this is but a suggestion of the actual and enormous

advantages which invariably follow. To-day the average farmer is either compelled to haul his fifty cent wheat to market before the rain comes, or hold the crop until the following May, when it may be worth much less. The intermediate good prices might as well never exist, so far as he is concerned. The condition of the roads stops him from taking advantage of them.

It is estimated by the Secretary of the National Farmers' Congress that the wagon transportation of the United States amounts annually to 600,000,000 tons; that this has to be moved an average distance of eight miles; that it costs an average of $2 per ton to move it; and that this is sixty per cent. more than it would cost if we had good roads all over the country—an extra cost in producing and marketing our agricultural products of $700,000,000. When it is taken into consideration that the total value of all agricultural products is only $2,800,000,000, it is perfectly plain that *one-fourth* of the *home* value of our farm products is lost by bad roads.

Texas gives a startling illustration of this in the movement of her cotton crop—a labor which requires less expense for road transportation than any other commodity of equal value. There are 750,000 tons of lint and 1,500,000 tons of seed, making 2,250,000 tons. This at $2 per ton (the cost of hauling over poor roads), equals $4,500,000—sixty per cent. more than it should be. With good roads, there would be saved there alone every year $2,700,000 on the cost of wagon transportation. This would pay an annual interest on $54,000,000 of 5 per cent. bonds. Expended economically, this would build 42,000 miles of good permanent roads, and earn the State money to pay the principal. In ten years Texas could have good roads, permanent and paid for, and her treasury would be the richer for the enormous increase of land values.

This, however, is but another instance. It has been figured out in New Jersey that land values tend to rise 30 per cent. in value wherever good roads are introduced, irrespective of other natural benefits. They are invariably the forerunners of other improvements, such as the electric railways, free mail delivery, increased demand for country residences, and so on. They create far greater social unity, they spread intelligence, they give to the isolated citizen a political significance not otherwise attainable.

So it goes after construction, but before there is, invariably, opposition. This comes, as I have suggested, not only from ignorance of cost and of results, but also of methods of building. This ignorance is so general and may so easily be dispelled, that

it becomes almost a duty to define the three classes of roads and explain how they are constructed.

As a matter of fact, there are three and only three—dirt, sand (or gravel, which is practically the same) and stone—Telford or Macadam—between which last there is little choice.

For *earth* roads, as commonly built, there is little to be said. They should be tolerated only in a new country, or where there is absolutely nothing but earth of which to make them. Yet, with earth alone, a passable road can be made and maintained, if

Old Willow Cycle Path and Road, East of Southold, Long Island

sufficient care is taken to have it thoroughly rolled and drained and the surface kept in a proper condition.

The sole value of the *sand* road is that it lasts longer than the common rolled dirt road. The real road, the good road of all the present agitation, is the stone road, Macadam or Telford, which costs from $5,000 to $8,000 a mile, and lasts for hundreds of years.

The principal difference between these two constructions is as to the propriety or necessity of a paved foundation between

the coating of broken stone. Macadam denied the advantage of this, while Telford supported and practised it. The Macadam system is the better under some conditions, while the Telford seems to have the advantage in swampy, wet places, or where the soil is in strata varying in hardness, or where the foundation is liable to get soft in spots. Under most other circumstances, experienced road-builders prefer the Macadam construction.

Macadam roads are built by covering an earth foundation with a compact crust of small broken stones. A trench about six inches deep is excavated, every foot of the surface thus exposed is examined carefully, all soft spots are strengthened, and all dead or perishable matter removed. The earth is then rolled, and over it is spread a layer of stone from two and a quarter to two and a half inches in face dimensions. The first layer is rolled to a thickness of four inches, and the top layer to a thickness of two inches. If the earth foundation is correctly prepared and sufficiently drained, if the stone layers are composed of stones of the right sizes and are carefully laid, a magnificent highway may be built in almost any locality where stone may be had at all, at an average cost of from $6,000 to $8,000 a mile. In level regions this cost may frequently be reduced one-half.

The earth foundation must be hard and dry, or the best built covering of stone in the world will prove worthless. An average of twenty-seven thousand tons of rain falls annually upon every mile of road in the United States. A good Macadam road should be waterproof. It should shed the water that falls upon it and protect the earth foundation upon which it rests. If this is done, and ditches are provided for its free passage to an outlet, sufficient drainage will be secured, unless the subsoil is saturated by springs. If this is the case, a system of subdrainage must be used.

The Telford foundation is composed of stones of various sizes, not exceeding ten inches in length and six inches in breadth on the broadest side, nor three inches in thickness on the narrow side. These stones are placed lengthwise across the road, breaking joints as near as possible; the interstices are filled with stone chips, all projecting points are broken off, and the whole structure is wedged, consolidated, and made as firm as possible.

This foundation should be covered with coarse sand or stone screenings, or if neither of these can be obtained, fine loam may be used, so that all voids may be filled, and the whole brought to a hard and uniform surface by thoroughly rolling. A layer of broken stone is then added, and treated as in the Macadam system. Where the funds will permit, and the traffic requires it, a regular

two-course Macadam surface may be placed upon the Telford foundation with good result.

The grade of a model road should never in any case be steeper than about one in twenty, and should be kept as much below this rate as possible. If the grade be made steeper than one in twenty a horse will in most cases be unable to haul his ordinary load up the incline without assistance. On first-class Macadam roads, in important localities, the limit should be one in thirty. Steep grades mean greater expense for repairs, for not only do they quicken the flow of water, which wears and scours the road surface, but they also subject it to a severe digging action of toe-calks when horses are hauling loads up the grade.

On a grade of nine feet in a hundred about four horses will be required to haul on a Macadam road what a single horse would draw on the level, and although, as before stated, a horse in pulling up hill can generally exert, for a short time, double the strength that he continually employs throughout the day, it is clear that, even with this increased exertion, he can only draw half his ordinary load up a nine-foot grade. If we subtract in each case the weight of the wagon from the gross load, we shall find the hurtful effects of the steep grade to be still greater; that is, if the gross weight of wagon and load hauled by a horse on a level Macadam road is 2,800 pounds, and the gross weight that he can haul with double effort up a short nine-foot grade is 1,400 pounds, and the weight of wagon in each case 800 pounds, then the net load hauled by the horse on the level road will be 2,000 pounds, while the net load hauled up the grade will be only 600 pounds. We see from this that a nine-foot grade more than doubles the cost of hauling.

Every State has its own peculiar problems to solve, and difficulties to overcome in its progress toward good roads. In the first place, it is necessary to awaken an interest among the people, to convince them that good roads will pay. It is then necessary to devise laws by which a successful system of building can be operated. Good soil and material are not as available in some localities as in others, but it has been found that all such problems can be solved where the proper efforts are made.

In treating with this subject of good roads, I have dwelt chiefly on the importance of the present movement from the economic point of view. This single phase of the subject has evidently struck a popular chord, our exposition in the May number of the magazine having received editorial comment from a large number of leading daily newspapers. But, in attempting to awaken a wider sympathy in the agitation, I own that I have at

heart the interests of the very large number of the readers of this magazine who are cyclists. It is the cyclists who are largely at the bottom of what has already been accomplished. In working for their own good, they have extended a benefit to the whole community, the magnitude of which could hardly be exaggerated. Better roads, then, by all means. On this subject some further articles will be published in forthcoming numbers, and I invite the co-operation of all interested citizens, whether in the form of formal action by cycling clubs, or as suggestions from individuals who have given this matter their consideration.

C. Arthur Pearson.

The First Real American Automobile Exposition

THE most important automobile exposition ever held in this country will no doubt be the Exposition of the Greater Inter-State Fair at Trenton, to be held next September 24, 25, 26, 27, 28. The Board of Governors of the Greater Inter-State Fair has wisely decided to afford all manufacturers of the United States an opportunity to show up their vehicles, without any great expense to them. They have erected a special building for the annual fair for the automobile interests and no charge is made for exhibition spaces.

Nearly every manufacturer will be represented by several vehicles of his make, also all the accessories will be exhibited. To judge at present from the applications filed with the Secretary, Mr. M. R. Margerum, more than 30,000 square feet will be needed.

Trenton is very happily located between the two big cities of New York and Philadelphia. The Automobile Department is a timely innovation, and will draw a crowd not only from the State of New Jersey, the cities of New York and Philadelphia, but from all over the country, as everybody is anxious to become better acquainted with the new mode of locomotion—the automobile.

It is easy to predict that in no distant time the United States will lead the world in this new industry, as we have the best mechanics and the best machine tools to produce the very best vehicles for the world's market.

First Real American Automobile Exposition

The managers of the Trenton Fair have offered a special trophy to the Automobile Club of America to organize a club run from New York to Trenton on September 22, two days previous to the opening of the Trenton Inter-State Fair, this trophy to be known as the New York-Trenton Cup. Another cup has been offered to the Automobile Club of Philadelphia to organize a club run on the same day from Philadelphia to Trenton. Only American vehicles to participate in these runs. These offers have been graciously accepted by the two clubs. The members of affiliated automobile clubs can participate, either in the run from New York to Trenton, or from Philadelphia to Trenton. All contesting vehicles will be on exhibition on September 24, the opening day of the Fair. Besides the five races organized for that day there will be contests of automobile stopping and automobile driving between obstacles. It will be the first time in the history of the automobile that such an exhibition will have been given in this country. A one-half mile driving track sixty-six feet wide, with curves raised two feet seven and one-half inches will afford an excellent opportunity to show all the good points of the competing vehicles in the races as well as in the other contests.

Several exhibitions are planned in the near future in the interest of the automobile industry, but we can surely predict that none will excel the Trenton Fair, as the whole industry will be represented there. The exhibition, under the auspices of the Automobile Club of America, to be held in November in the Madison Square Garden, will permit only a few manufacturers to show their makes, and will only include about a dozen or fifteen manufacturers, while in Trenton, over 300 houses will be fully represented. The Jury of Awards as well as the Stewards of the Races of the Trenton Inter-State Fair consist not only of the most notable scientists of this country, but of the most enthusiastic members of the Automobile Club of America and the Automobile Club of Philadelphia.

The grand stand, as well as the Exhibition Building No. 1, lately destroyed by fire, has been already replaced by fireproof structures.

The Use of the Automobile for Rural Traffic

THE century which is now approaching its end has witnessed the creation and development of the railway—the most efficient of all means of transportation. The extraordinary effect which the invention and extension of railways have had upon our economical and commercial development need not here be dwelt upon. The world is covered with a network of steel tracks; and the railway undeniably occupies the foremost place among all systems of transportation.

Powerfully as our commercial life has been influenced by the steam-railroad, the ideal method of transportation has not been attained, and cannot be attained by the railway with its pretentious system of stations and tracks.

Our transportation facilities have been improved chiefly for the purpose of accommodating the largest possible number of persons or quantity of goods, and of carrying them to their destination in the shortest possible time. The steam-railway has, therefore, supplanted all other means of conveyance and even degraded the horse-drawn vehicle to the position of one of its auxiliaries. The centralization of traffic has now almost reached the end of its career. In civilized countries there is no necessity for building new railroads; and the development of the lines already in existence is confined chiefly to the construction of branch and auxiliary roads running to districts not connected with the main line.

The enlargement and extension of existing roads show the limitations of the steam-railway. The railroad rarely meets the requirements of flat regions. Owing to the very small traffic, even the narrow-gage road cannot be profitably operated between small rural communities; nor can its time-tables be always adapted to the needs of places not remotely situated from one another. For adjacent villages and towns a smaller, less pretentious system of transportation is evidently required, which, though less efficient than the larger railroad, is better suited for the purpose of establishing a profitable means of conveyance. Beyond a doubt automobiles are the best vehicles for the limited traffic of the country. They are destined to connect rural communities, not only with the nearest railroad, but also with one another.

The Use of the Automobile for Rural Traffic

In districts where there is temporarily considerable passenger and freight traffic, automobiles will be particularly serviceable. Summer-resorts, for example, which during the warm season of the year are much frequented, are well-nigh lifeless during the winter. The building of a railway to such places would be unprofitable; but a line of automobiles running to and from the nearest railway would meet all requirements and would, moreover, be much cheaper.

Mechanical traction without rails is free from the disadvantages attending the use of tracks and does not necessarily entail a loss in speed. The automobile is therefore destined to play an important part in the economic development of prairie communities. In order to strengthen our argument by means of a concrete example, we have but to mention the great possibilities of the motor-car in the improvement of our rural postal service. The high speed which can be attained on good country roads would certainly bring about a quicker distribution of the mails and consequently greater efficiency in the postal service.

If automobiles are to fill the wants of country districts, it is evidently necessary that roads be built which will be adapted to the needs of the new means of communication. The highways must be as level as possible; the grades must be few and slight. The roads should be kept in such condition that the vehicles would not be jolted and subjected to violent strains. In the delicacy of its driving mechanism, the motor-carriage differs widely from the animal-drawn vehicle; and for this reason alone good roads would be a necessity.

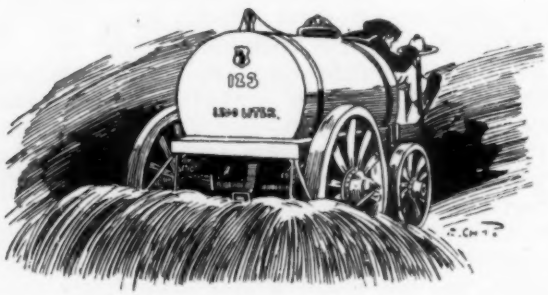
Not until the highways have been rebuilt or improved will the full efficiency of the automobile be recognized in country traffic. Any positive opinion on the automobile is therefore premature. With the present lack of facilities on our country roads, it is no wonder that the motor-carriage has not always fulfilled the expectations of its champions.

But the building of roads especially adapted for automobiles is not all that is required. It will be a matter of the utmost importance to reserve for the motor-vehicle the road upon which it is to run, and to divert to other channels the animals and vehicles which may hamper it. Special paths have been opened for bicycles; and there is no reason why automobiles should not enjoy similar privileges. A division of automobiles into light and heavy vehicles would also be advisable. If there were divided roads for light and heavy automobiles, the problem of maintaining the highways in proper condition would be considerably simplified. The light, swift carriage could then speed along without

being suddenly checked by a slow, heavy truck. The provision of sidewalks for pedestrians has been one of the means of preventing a congestion of the traffic of large cities. A further improvement could be made by classifying the vehicles according to weight and speed.

Such a division of vehicles is even now possible on our roads. To be sure there are avenues and streets which are too narrow to permit a separation of light and heavy vehicles. But something must be done, with the rapidly increasing number of automobiles, to prevent the blocking of the way by cumbersome wagons. The obstacles to be overcome in attaining the desired end are not unsurmountable, especially when it is considered how the building of roads has been modified in the course of time. The old Roman roads, which extended over half of Europe, as well as the roads built during the Middle Ages, were constructed in straight lines. They extended over the highest mountains; no hill was too steep nor valley too deep. Nowadays roads are curved and bent so as to avoid all steep inclines. Mountains are ascended by serpentine routes. The change has been brought about by the constantly increasing use of draft-animals. The substitution of the circuitous route for the direct roads of the Romans will find a parallel in the construction of automobile highways, which will fill the wants of the future means of transportation.

Improvements in road construction go hand in hand with improvements in the vehicles of trade. Every step in the development of road-building has been due primarily to better means of transportation. Highways are gradually adapted to the demands of transporting vehicles; and only when adequate roads have been provided can these vehicles develop their full efficiency.



The Automobile Abroad

(By Our Own Correspondent)

THE English Motor Club is a new organization in London. Regular Saturday afternoon runs will be a regular feature.

A gentleman from Boston, England, was recently brought into the police-court at Spilsby, charged with running a motor-cycle at a furious rate, frightening horses attached to a heavy cart. It was shown, however, that 16 miles an hour was the maximum speed of the motor, but on that afternoon it had been geared down to 12 miles an hour, and that the man in charge of the horses was both inexperienced and careless. The magistrates said it was their first case of the kind and they held the evidence to be "conflicting," so they recommended the withdrawal of the complaint on the payment of the costs, 20 shillings, by the gentleman.

Two new companies organized in England are the Ceylon Rapid Transit Company, Limited, and the Motor-Wheels Company, Limited.

A dealer in bicycles and automobiles at Scarborough, England, was lately fined for scorching with an automobile while drunk. The offense deserves heavy punishment—even imprisonment. An automobile is the last place for an intoxicated person. Total abstinence should be observed on the road.

An English chronicler has discovered that the cyclometer was invented over 250 years ago, a Colonel Blunt having had one on his carriage in 1637, giving the distances in miles and thousand miles.

A very significant and important step is that of the Frankfurter Rennklub (Frankfurt Racing-Club), of Frankfurt-on-the-Main, in adapting its magnificent course at the Forsthaus to automobile racing. On July 29 the first automobile race in Germany on a regular racing-track will be seen. The regular horse-races of the club will be held on the same day.

The prominent German writer on sport, Richard Koelich, recently made a long-distance tour with his wife on a motor-tricycle with voiturette attached. He intended to make a journey of a month, but at the end of eleven days his business called him back. Owing to bad weather three days of travel were lost. In eight days a distance of 1,200 kilometres was made. The jour-

ney was through a most interesting part of Germany. Starting from Aix, the route lay to Cologne and then up the Rhine to Mayence, up the Main to Frankfurt and thence to Mannheim, through the valley of the Neckar to Heidelberg and Stuttgart, across the mountains to Durlach and again to Mannheim, and back to Aachen by the same route from Frankfurt. The entire consumption of benzine was 54 litres, or 1 litre to every 22 kilometres. The total weight, including persons and baggage, was about 300 kilograms.

A novel race was that between an automobile and a balloon,

Scene from "The Juggler of the Nile," at the Metrepol Theatre, Berlin

recently held at Friednenau, near Berlin. In spite of getting stuck in a morass for awhile, the automobile came out ahead by nearly 10 kilometres.

The Greek Government has given Konstantin Moraiting a franchise for an automobile service covering the whole kingdom, including both passengers and freight-transportation.

The third annual German bicycle fair (Fahrradmesse), to be held at Leipsic October 19-23, will have an automobile exhibition as a feature.

The automobile exhibition in Frankfurt, Germany, will be held July 14 to August 12.

The Automobile Abroad

The permanent traffic commission (commission permanente de circulation), in consequence of the complaints of residents of streets traversed by tramways, has prohibited entirely the use of the horn as a warning-signal on vehicles. Bicycles will probably also be included in the interdiction. The use of bells, or gongs, as universal in the United States, will be required, and conformity with certain models insisted upon.

Following are the totals of the prizes offered for this year's main racing-events for automobiles in France: The meet at Nice, 10,000 francs; Paris-Bordeaux run, 14,000 francs; Paris-Ostende run, 15,000 francs; Exposition road-run, 47,000 francs; Exposition track-races, 24,000 francs; Pau meet, 8,000 francs.

The course for the long-distance run between Salzburg and Vienna is to be policed by a squadron of cavalry and a detachment of soldiers on bicycles. Between the last localities traversed a military telegraph corps is to lay a light line to announce the results. It is likely that the cavalry will be more of a hindrance than a help.

The Vienna automobile exposition opened on May 31 and closed on June 10. The interest shown was greater than ever. A remarkable number of new types were shown and the exhibits were full of evidences of great progress in the past year.

The new Brussels automobile cab-service will be equipped with six-seated vehicles of German make, with six horse-power motors. The fare is five francs an hour for two persons, two francs additional for other persons, with a maximum of eleven francs for six persons. For several hours' use the charge is ten francs an hour.

The Prince of Oldenburg has lately made a tour of 500 kilometres in the Caucasus, between Novorossik and Sukhum, on a Gardner-Serpollet steam automobile.

The automobile is making itself felt in Spain, where there are many admirable roads. A motor-omnibus service is to be instituted between Oviedo, Siero and Villaviciosa.

Custom and the Automobile

IF the horseless carriage, like the poor and the single tax agitation, we are to have "always with us," it is to be hoped that we shall some day cease to miss the horse. That, though, cannot come about until some genius shall invent and persuade us to accept such forms of the new vehicle as will enable us to forget him. But in order to do that we must forget the vehicle that he drew—that is to say, we must have a vehicle whose difference from the old one consists in something more than its horselessness. Nearly every part of the one that we have has been constructed with direct or indirect reference to the animal that used to pull it, and fond recollection presents him to view as still pulling it.

Divorced from him it looks bereft, uncomfortable and helpless. It offends the eye, shocks our sense of the fitness of things and is a sore trial to the spirit generally. Probably, though, its horse-born features will remain in evidence for centuries after their origin is forgotten. Posterity will regard them as essential parts of the automatic scheme—will feel (for example) that without a "dash-board" the thing could not be made to go.

It requires generations for us to learn how best to do a new trick evolved from an old one. You shall not cast your eyes anywhere among the works of man without their resting on some "survival"—something that once had a purpose and a meaning, but has long ceased to have either, and is perpetuated by nothing but a stupid, unreasoning conservatism—a habit of continuing to do what has always been done.

I could fill this entire newspaper with instances in point. Why have so many buildings watch-towers without watchmen, battlements from which to fight no battle, bastions loopholed for archers, and so forth? Go into a cemetery and observe the number of marble, granite and bronze "urns."

When cremation was the rule (most of us think it is a new fashion), real urns were used to hold the ashes of the dead. There are ashes no more, but the urns are there all right, and in explanation we say they are symbols. That word "symbol"—what a multitude of stupidities it covers! To-day a convenience, to-morrow a superfluity, the next day a symbol—such are the genesis and development of things most precious to the sentiments. But the days are ages long.

Not all survivals are "symbolic": only such as touch the sentiments. Most are merely nuisances; but we go on making

the thing, or doing the act, as diligently and gravely as if it were needful. The merchant vessel of to-day is frequently painted to look like a war ship with portholes for cannon. That is to scare away the pirates. The pirates have all left the high seas and gone into business on land, but that makes no difference; the traditions of the ship painting art require the dummy portholes.

Did you ever see an actor open a letter on the stage? He probably struck it a smart blow with the tips of his fingers. That was to free it from the sand which fifty years ago was used to "blot" letters, and some of which would stick to the wet ink. The actor never heard of the custom, but he taps the letter just as if he knew why.

Why do we bow? To show deference. Yes; but how does bowing show deference any better than lifting the foot or turning down the thumb? When one of our savage ancestors met another child of nature to whom he wished to be gracious he bent his head before him by way of saying: "See how I trust you! Cut it off if you want to." We have inherited the habit—it is a "survival." So is the handshake; the primeval gentleman showed his good will and good breeding (both always open to suspicion) by delivering his weapon hand into the keeping of the other person, who responded with his own.

Why does your tailor sew two buttons on the back of your frock coat? To sustain your sword belt—and you would not take the coat without them.

In England and several other European countries the railway coach is still so made and painted as to resemble three stage coaches in line. Why? Because in the mindlets of the first builders of railway coaches that form was associated with the most rapid locomotion they knew about and with the carrying of passengers.

The builder of to-day has not ventured to alter it lest some appalling calamity befall. It cannot be too often repeated that man is of an intelligence but little inferior to that of the gods. He made the gods.

So we shall doubtless have the automobile for a few centuries without material change of form—that is to say, crying out audibly for the horse. It is rather a pity, for it offers great opportunities to the artist. It could be made beautiful exceedingly.

I have no designs to submit for rejection, further than to suggest a study of the prow of a Greek galley, or a Venetian gondola, with a view to emancipation from the hideous "dashboard."—AMBROSE BIERCE in *The New York Journal.*

The First Automobile Lesson

LEARNING to drive an automobile probably comes as near the heart disease limit in human doings as any one event of ordinary life. When Richard III. made his famous bid for a horse, the automobile was not. There are many Bostonians, probably, who cordially echo the wicked King's cry: "A horse! a horse!" etc.; anything whatever less cranky, cantankerous, crotchety and with a more subdued enthusiasm for riding over everything but the road.

It seems so easy while one watches the "automobilier"—the man who guides an engine is an engineer; the steersman of a gondola is a gondolier, and, by analogy, the director of the energies of an automobile may be an "automobilier." The thing shoots along the boulevard at a rattling pace, corners are turned with surprising ease, the apparatus comes gracefully to a standstill; in fact, it "gees, haws and backs" with all the docility of a well trained horse. When the owner or renter takes it in hand for the first time, then it is truly "a horse of another color," and certainly of a different—oh, how different—disposition. All the vices and irregularities of the sum total of equine perversities are as nothing compared to it.

After explaining the thing and illustrating the action of the starting lever, steering bar, reversing lever and brake, by sundry dexterous turns of the wrist, the instructor changes places with the luckless beginner, and then the fun begins. Particularly if one is accustomed to horseback riding is the first trip on an automobile a strange and fitful experience.

"This is easy," the new automobilier says to himself as, with the right hand on the steering bar, he pushes the starting lever a single notch forward. This only sends the machine at a very moderate pace. The road is straight and smooth, and everything goes easily. There is a feeling of exhilaration, and, with a thought of "I wonder who I know is looking," the new operator rashly pushes the lever forward as far as it will go.

With a bound like that of a high-bred horse under the sudden sting of the whip, the machine bolts forward. The steering bar, which was so easy to handle at the slow speed, now seems to be endowed with life, instinct with some diabolical agency. It will never stand still. Instead of keeping straight ahead, the machine is continually wabbling, and woe to him who may be driving anything on that road. The perverse machine takes it all, with an absurd preference for the sidewalk.

Then the instructor comes to the rescue and saves the luckless amateur from an untimely death. With a change of heart amounting to a camp meeting conversion the machine, which was a moment before vicious, hard on the bit, balky and obstinate, lays aside all these vices and, coming back to a state of grace, darts along the road like an express train.

While the new driver is drawing a breath of relief and wondering what could have possessed the machine before, it comes as sort of a shock to hear the instructor saying: "You rather lost your head that time. Now, try it again, and keep the steering bar steady."

Holding the steering bar with a grip that almost dents the handle, the automobile speeds on. No deviation this time; straight as an arrow the thing shoots. Down the boulevard speeds the machine, when, all of a sudden, half a newspaper blows across the road. The new operator, with all his experience of horseback riding, needs no hints from the instructor as to what he should do in this emergency. Holding the starting lever firmly with his left hand—though what for, neither he nor any one else could say, as the machine is doing its prettiest already—and the steering bar in his right, he deliberately turns his horse's —no; the automobile's—head toward the fearsome object. Almost instantly the machine becomes a bicycle, so sudden is the slew that the quick turn has caused. The instructor seizes the steering bar, and, by bringing it back to "straight ahead," averts an overturn by a hair.

"Never had a horse shy like this," mutters the neophyte, as he takes the bar again.

All goes well for a time now. The machine is on two-thirds speed and acts very well. Two-thirds speed is not very slow, however, and before long the automobile arrives at a street where the electrics cross the boulevard. Still thinking of the horse, and wishing to keep the thing from stumbling on the car tracks, the new beginner slows up. Where, oh, where is that brake! After more or less shuffling, the foot finds it and, with a forward pressure, releases the catch that holds it in position on the comb. Gently as possible the thing stops. The track is crossed and no accident has happened. Then the brake is released and swung back into place, but still there seems to be no increase in speed. In fact the machine goes slower and slower and finally stops. The starting lever is certainly forward, where it was when indicating two-thirds speed.

Anxiously the volt-meter placed under the shadow of the

dasher is examined. That certainly indicates plenty of power left in the storage battery. Something must be wrong with the machinery. It is a relief to learn that there is nothing the matter. The machine is not balky nor injured. When the brake is set, it cuts off the power. The starting lever is pulled up in first position, then forward, and another start is made.

Somewhat rattled by previous mishaps, the first half mile is now done without much pleasure. One's whole mind is centred on the management of the machine. The surrounding scenery is enveloped in a sort of haze. Little by little, as ground is covered and nothing untoward happens, the new operator begins to notice other things. That was a handsome house that was passed, he thinks to himself. One by one objects begin to impress themselves on the senses. The mist clears, and with a keen sense of pleasure and exhilaration, the next half mile is passed.

Everything is going smoothly. The machine has been conquered, and the lever is pulled to the third notch. At a rattling pace the automobile now dashes on. Automobiles forever. Horrors! Is that nurse going to trundle that perambulator across the street? Will she never look this way? Down brakes, quick!

As the new driver painfully gathers himself together and sorts himself from the clinging gravel and mud that has stuck in artistic clusters on his clothes after he went flying over the dasher, his criticisms of the sport of automobiling are not fit to print. If he is not cured, the fever is in his blood and he will try again, each time with increasing pleasure.—*Boston Herald.*

War and Power Traction*

By the Right Hon. J. H. A. Macdonald, C.B., LL.D., F.R.SS. (L. and E.) (Commanding the Fourth Brigade).

At a time when war as a factor in national life has been brought home to this nation in a very sudden manner, all who are interested in power-traction will, I think, agree that the question of its applicability to the purposes of war should be studied. There are two aspects in which it presents itself—the combatant and the non-combatant. The first relates to the uses which can be made of power-traction to move weapons of war to and within the area of the actual fight, and to carry armed men into or out of that area, and, it may be, to give them practical aid and protection while fighting. The second, and in some aspects the more important, relates to those less stirring, but absolutely essential operations which take place outside and even sometimes inside the fighting zone, by which the necessary supplies of ammunition, food for man and beast, camp equipment, ovens, and many necessary stores that need not be particularized, as also engineering implements and explosives, pontoons, horse-shoeing forges, duplicate parts, repairing tools, ambulances and many other indispensable appliances and munitions can be carried along with the army, so that it may be kept efficient, and maintained in strength and health and equipment for the exertions it must undertake. As regards the feeding question, there is no truer saying than that which is often quoted—that "an army marches upon its belly," and if this were kept in view, we should not often hear the cry "Why doesn't General ———— get on? What's the good of his sitting doing nothing; he seems to be wasting time terribly."

It is plain that if means can be found by which the length of the transport train conveying a certain quantity of material may be reduced, the difficulties of transport and supply would be diminished in a corresponding degree. And further, if speed could be increased, still more advantage would be gained. At present, if a large force starts by one road, say, at 4 A. M., the last wagon may not move off for two or three or even four hours after that time, and will arrive at the end of the day's march correspondingly late. Therefore every reduction in the length of the column and increase in the speed of movement would be a

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great gain. Again, if the haulage be done by animals, delays for feeding are a necessity, and difficulties of watering may be serious and even in some cases make the use of a particular road impossible, or affect injuriously the laying off of marches, as halts cannot be made where water is not within reach. Add to all this, that in the case of animal traction, if the weather is very wet or very dry, the road will, under the shoe-pressure of such a multitude of traction animals, dependent upon foothold for their efficiency, have its surface completely destroyed, and thus made to cause greater wear and tear to animals and vehicles following, and possibly, if the road becomes badly rutted, to cause a serious breakdown of rolling stock, and impose much wearing fatigue on troops requiring to march by the road after some of the wheel traffic has passed. In short, war brings into exaggerated relief every disadvantage which appertains to animal traction. Notwithstanding its many disadvantages, animal traction has been till very lately the only mode of haulage in use by armies in the field, whenever any freedom of movement, either strategic or tactical, was sought for. A railway, of course, will bring forward supplies very rapidly, and as long as an army can accomplish what it has to do while clinging to a railway, no transport could be more efficient. But if an army is tied to rails, and has to limit its operations by the necessity of keeping close touch with an iron road, its commander loses all freedom of manœuvring, and his opponent is able to forecast his every move and foresee how far he can carry it. The present war has illustrated this very forcibly. As long as the commanders in the west and east of the seat of war were compelled to hold on to the railways as their means of conveying bulk supplies, the Boers could make up almost impregnable positions to bar their progress. But where, with road transport, our generals were able to move out from the railways and round the entrenched positions without losing the power to bring food and supply munitions of war to their forces, the whole scene changed as by magic, and our opponents had to abandon their carefully prepared positions in haste, and even to suffer disaster.

The use of the road being thus an essential of successful military operations, does this not open out a promising prospect for those who are engaged in developing power traction? To this there can be but one answer from all who are familiar with the progress in mechanical haulage which has been already made. Even the now old-fashioned traction engine is not a power to be despised for army transport. At the risk of the imputation of egotism, I will say here that the volunteer brigade under my com-

mand was, as I believe, the first military unit to employ power traction in this country for this purpose. Five years ago, having arranged that the brigade was to march to camp as an exercise, the distance being a full day's march according to the military standard, I authorized the supply and transport department of the brigade to make a contract for the whole equipment and stores for 1,500 men to be conveyed by two traction engines. The military authorities at headquarters shook their heads over the proposal, prophesying that we should find our tents in the ditch when they should have been pitched, and our men waiting in vain for their evening meal when it should have been ready. But it was not so; our train came in in good time. There was, indeed, an accident to machinery, by which for the last mile or two one of our engines was not sufficient, but the other, with its reserve of power, took on all the wagons, and triumphantly brought them in. On our return march, the whole was accomplished without a hitch. Since then the War Office has become alive to the value of this mode of haulage, and a number of traction engines have been doing excellent work in Natal. I am informed also that an efficient traction engine transport was organized in India many years ago by Lieutenant-Colonel Crompton, who is at present engaged in obtaining additional steam transport for South Africa.

But such engines, drawing trains of wagons, are not the most suitable for military transport work. It is rather in the single self-driven wagon of moderate size, dragging one other wagon behind it, and having a capacity for speed considerably more than —say double—that of the ordinary traction engine, and with its machinery so placed as to add little to the length of the vehicle, that the most practical application of power traction for war supply is to be expected, for this would reduce the space occupied by a supply train on the road very considerably. In the first place, as the exigencies of military wagon transport make teams of four horses in many cases a necessity, a power train of double wagons would not take up so much as half the length of road occupied by an animal-drawn train, even if the wagons carried no greater load than at present. This, both from a convenient supply point of view and also from a military point of view, would be a much-to-be-desired improvement. For, of course, if a train is reduced to half its length, the necessary guard will only employ half the number of fighting men, and the exposure to risk of raids on the line of communications is diminished proportionately to the shortening of the line of vehicles. But the diminution would be more than one-half, for as a train of 1,000 wagons will require

probably 2,500 horses at least, in many cases the team occupies more road than the wagon. And where so many horses are employed, a considerable proportion of the train must be taken up with the necessary supplies for feeding and the appliances for tending, nursing, shoeing, clothing and picketing the animals, and repairing and renewing harness. Also, as one man can only take care of two horses, the equipment and supplies for many additional men must be conveyed as compared with a system in which one man would take charge of each traction unit. Against all this there would be nothing to set except the weight of fuel and provision for repairs on machinery. Further still, a horse-drawn military wagon can seldom be loaded up to the extent of more than two tons, even if drawn by four horses, and therefore there would be a still greater reduction in the length of train, if each power vehicle could carry, say, four tons of load. Thus, if the horses were eliminated and the number of wagons reduced, it is not saying too much to assert that a convoy might be brought down to one-third of the present length, or even less.

Road difficulties would also be diminished in a marked degree. The surface of the road would not be cut up as it is at present, making it in dry weather a sea of dust, destroying foothold and causing wheels to run heavy, and rising in clouds to parch the throats, clog the nostrils, and close the pores of man and beast, while in wet weather it becomes a quagmire, hiding ruts and hollows produced by the excessive traffic, rendering marching a distressing exercise and traction an excessive strain on animal endurance. Also the power train, one-third of the length of the animal train, could be moved at six or even eight miles an hour, a speed twice as great as is now possible. Thus, while at present it may take some hours before the last wagon of a train can move off after the first starts, and accordingly it must come in the same number of hours late at the end of the march, an efficient power system would reduce the time to one-fifth of what it is at present. The capacity of the road for movement of troops and stores would therefore be greatly increased, and the fatigues and risks of the road sensibly diminished, as well as the delay at the close of the march by bringing up camp equipment and providing refreshment for the weary troops. Indeed, in any cases where an advance guard reported that the country in front was clear of the enemy, the supply officers could make use of their superior speed, could take with them a fatigue party and the cooks belonging to their column, and make progress in providing a meal while the troops were still on the march. And no one who has not experienced it can realize the difference it makes to the soldier, if after a long

day he can at once, or at least without a tantalizing delay, obtain his cooked meal. A wait of two or three hours in an exhausted condition in the evening may lower his capabilities for marching or work the next day, and his entire *morale* for more than one day, and in a very considerable degree. It is safe to predict that efficient power traction would do much to prevent risk of the soldier being exposed to such trials of endurance and the consequent loss in strength and addition to cost.

Add to all this, that the mechanically driven vehicle is not like a hauling animal in one particular vital to the question—it does not require periodical stoppages of considerable duration in order to gather physical strength that has been exhausted. An animal can only do a certain amount of work in a day. The power vehicle is not limited to what is called a day's work, and compelled to rest when extra work has been done. It is as fit for work the day following a forced march of, say, forty or fifty miles as when it has been standing idle for a day. The commander has no questions of exhausted transport animals to consider, a matter which may often be most serious, hindering his freedom for advance and greatly increasing his difficulties in retreat.

All these considerations tend to one conclusion—that successful enterprise in the construction of transport vehicles for war purposes will be of incalculable service to an army in the field.

Turning now for a short time to the combatant side of the question, it will be seen at once that the possibilities of substituting power traction for animal haulage are much more limited than in the case of transport. As regards all cases where the road is to be left for the open country, the only traction which requires to be seriously considered is that of guns and machine guns. And it is evident that as these must often be forced over broken and even obstructed ground, power traction, as far as it has been developed up to the present time, is not practicable. Any one who has seen the way in which even field batteries are made to fly over ditches, low fences, and boulder-strewn ground, and up heavy gradients, can have no doubt on this matter. Until lately there has been no development of traction at all within the fighting zone for any other purpose than the handling of artillery, ammunition supply carts and water carts. But we have in the armored train the first beginnings of the use of power traction for combatant purposes. Both in Egypt and in South Africa such trains have done useful service, although their capacity for good work is necessarily limited by their being confined to a fixed line of railroad, which is easily destroyed, and if in any degree broken

up may reduce an armored train to nonentity, and expose it to capture. National defence is the primary consideration in the development of fighting resources, and if roads can be effectively used for fighting by aid of power-traction there is no country better equipped for doing so than our own. I think it will be found that there is great scope for development in this direction. High-speed motor-vehicles, with bullet-proof sides, would be of great value in the advance-guard and rear-guard work of an army. Such vehicles, capable of a speed of 15 or 20 miles an hour, could be moved out in front for long distances, each carrying ten or a dozen men and followed by cyclists who could search the country between their own road and the next on their flank, sure of assistance from a pivot machine gun on the wagon in covering their retreat if driven in, and confident that they could run the gauntlet and get back under its protection if they were outflanked or outnumbered, the cyclists using the armored car as cover by riding in front or at the side of it during retirement, according to the direction of the enemy's fire.

But still further, there may be good ground for believing that the introduction of power-traction may prove the solution of the difficulty which to some extent hampers the efficiency of the fighting cyclist. But if cyclists were accompanied by a fast moving armored power-vehicle, they would have much greater freedom. Ingenuity would provide a locking bar arrangement by which the cycles could be made up in groups, so as to run upright freely when hauled by the wagon. Thus they could be taken forward or back as required. The rifleman having been brought rapidly forward by his bicycle, would be able to do his field duty without troubling himself about the safety of his machine, which would be moved about and defended by those working the small moving fort, with its Maxim gun, and both could thus do their duty for the general end in view, the rejoining of cycle and man being for the time a secondary question.

Such small mobile forts as have been spoken of would certainly be useful in many ways. They might be invaluable in protecting a flank of an advance in battle, and nothing could be better in a retirement for enabling a rear-guard to hold on for some time, and so check a pursuing enemy. Their high speed would also make it possible to move them by crossroads to any point of a line of battle where they might be of service, and, of course, wherever there was fairly even surfaced grass land they could be taken off the road and run over the open country. Like the old *testudo* of the Romans, they would, in moving, carry their own cover against the missiles of the enemy, but with the

advantage of traveling at a speed in proportion to the increased range of modern armament, and being able to disperse for fighting, with their *testudo* to aid them, and on which they could fall back, they would combine some of the mobility of the hare with the hardness and shell of the tortoise. Where it was necessary to defend, or to assault a bridge or a defile, or to repel an assault, such vehicles would be invaluable to race forward and cover an attack, or to hold on as a tortoise fort in defence until reinforcements could arrive. In a day when cover from musketry fire must be sought by both attacker and defender in the field, such movable armor would often be most useful as an aid to success in fighting.

I will ask you to consider two more points. The first is whether in such an accident as happened to our guns and convoy three weeks ago, to the east of Bloemfontein, the presence of a few military armored wagons with pivot machine guns and haulage power, might not have made all the difference in saving of guns and the protection of the convoy. In these days when a successful ambush is a veritable death-trap, and when it is not bravery but foolhardiness to ignore cover, are there not great probabilities before us in mobile cover obtained by mechanical traction? The second is, whether there is not great gain in possessing a haulage power which has no nerves and no vice, which has no tendency to stampede, and never sulks or jibs, is unaffected by tetse fly, and never takes the bit between its teeth.

Allow me now for a few minutes to sketch what might be the traction equipment of an army in the field in the next great war, which, let us pray, may find us neutral. Out in the front, on every road, armored high-speed vehicles mounted with pivot machine guns, such as I have described, to co-operate with the mounted troops and cyclists in covering the advance, feeling for the enemy, and capturing and holding bridges and fords and places of vantage, and at another time aiding in the converse duties in covering a retreat, and also in general engagements giving support at points as required, and protecting flanks; in the transport, power vehicles, with a maximum speed of, say, 8 to 10 miles an hour, every tenth or twelfth being a service vehicle, armored, and of extra speed and horse-power, carrying a pivot machine gun, the driving engine so fitted that its power can be used for working purposes, each being supplied with, say, 20 or 30 fathoms of steel ropes. These service vehicles would also carry certain appliances; for example, one would carry a small forge or smith's tools; another, wheelwright's plant; another, spare parts for the driving machinery; another, screw jacks,

anchor pulleys and block and tackle for heavy warping work; another small arms repairing plant; another spare bullet resisting plates; another search-light appliances; another an entrenching plow, to be hauled by steel cable, and all would carry some entrenching tools. These vehicles would be the centres of defence of the convoy, and a power traction transport would have many advantages for its own defence. In the case of horse traction drivers must stay by their horses and manage them, but with power traction all drivers can concentrate with the escort at the armored vehicles, thus making the defence stronger. These vehicles being mobile could be moved as the exigencies of the resistance to attack might make necessary, and being armored they could offer a much more effective defence. Again, where steep hills are encountered these service wagons having extra horse-power could assist the ordinary wagons. In case of necessity they could be used with their steel ropes to work the wagons up gradients, either by warping over an anchored pulley at the top of the hill, or by simply first ascending the hill and towing till the towed wagon reaches the top and then returning to tow the next. One can imagine how much time would be saved in such a case. One can also see that where, as is the case in the present war, it is necessary to move heavy guns up very steep slopes, such service-power wagons could be anchored and used to haul by wire ropes over anchored pulleys, and with block and tackle where necessary, instead of using teams of eighteen or twenty oxen, and in some cases hundreds of men. These are but some of the prospective advantages of mechanical traction. Many others will present themselves as experience widens. Lastly, these service wagons having extra power and only carrying a light load, could be attached to and haul any transport wagons whose traction power might be disabled from any cause.

It only remains in this outline of the subject to consider what is the best class of motor to be employed. It would appear that there are at present only three possible sources of power which would be suitable for the class of work which is likely to be required in war—steam, heavy oil, or light oil. The other sources of power sometimes used in traction—compressed air and electricity—are evidently out of the question. Kerosene, petrol or benzoline, although they have proved themselves highly efficient for ordinary road traction, present serious difficulties when it is proposed to apply them to war transport. They are ill adapted for use in hot climates, and might be a source of considerable danger if carried in bulk in a military wagon which may be struck by heavy shells, and the volatile spirit scattered over the

wagons near and set on fire. Heavy oil does not present the same difficulties, and it may be found that the progress of invention will develop this mode of traction to a high practical efficiency for wagon haulage. Steam raised by oil fuel or by a combination of solid fuel and oil fuel presents only two difficulties; the one is its dependence upon a water supply sufficient in quantity and of a quality not tending to incrustation. Such a supply may not always be available, and without it steam traction must break down. The other difficulty is that any escape of steam would betray the presence of the convoy to the enemy at very great distances. Everyone knows how easily condensed steam can be seen over many miles of country. Upon the whole, although one must express any opinion with diffidence, it seems likely that explosion engines worked with heavy oil give the greatest promise of success for war transport.

It is certainly matter for congratulation that while on the Continent and in America attention in motor-traction circles seems to be mainly concentrated on fast passenger vehicles, much progress is being made in this country in the development of heavy van and wagon power traffic. Those who are engaged in the study of this important branch of a new industry may rest assured that there is a great field open for design of vehicles suited for war purposes. The present war has led to Her Majesty's Government announcing many changes in the military organization of our forces in time of peace. And one of the most important of these is that the volunteer force is to be supplied with transport, the purpose being that there may always be a large number of standard military vehicles ready for use on an emergency. It will lie with the manufacturers of mechanically-driven wagons to convince the War Office authorities that they can turn out efficient vehicles for transport purposes. If so, it is difficult to believe that they will not be adopted, and orders given for their supply to our home defence forces, for nothing can be more certain than that such vehicles, if found practical, will be most suitable for the purpose. In time of peace transport carriages must necessarily stand idle for considerable portions of the year, particularly if employed for volunteer corps. Intermittent horsing is always expensive, and as a preparation for active service most unsatisfactory. But the motor part of a power wagon can be always ready for use, and will cost nothing for up-keep beyond the price of proper preservative grease when it is laid up unused for a time. At any moment it can be turned out efficient, and the training for its management under proper skilled inspection is not difficult. And as the wagons can be constructed for heavy

loads, and can cover at least twice the number of miles that can be covered by animal traction, in any given time, a much smaller number would be necessary, thus compensating for any extra initial cost per wagon.

May the British citizen, from motives of humanity as well as of patriotism, give attention to the question of war traction, and if he does so, the members of this club cannot doubt that mechanical power will prove itself efficient above all other modes of road haulage. But the designer and the builder must not wait until a government department seeks them out and asks for their aid. The war authority is too busy at present, making the best use it can of the means now at its command, to take any initiative in the adoption of new appliances. But the departmental powers of other nations, and notably of Germany, having no war on their hands, are working at the problem, and we are told that the Emperor has offered a large premium for the most suitable motor-vehicle for war purposes. Our designers must not be behind the world, nor must they wait for offers of premiums. They must put trust in their own exertions and in nothing else. Let them put before the country, as we know they can, specimens of their thought, their experience, and their inventive power—vehicles which will not break down under trial, but will be as efficient for the road as the locomotive engine has so long been for the rail.

Trend of Progress of the Automobile

By R. H. Thurston

Third Paper

ON the other hand, cheap mineral oil or other petroleum product or the by-product of manufacture, condenses nearly double the amount of energy within a stated weight that can be had with coal of average good quality, is free from ash, can be readily insured against the production of smoke, need not give offense by odors and is easily arranged for automatic supply and regulation to the momentary requirements of the motor. It is also easier, with this fuel, than with solid combustibles, to secure thorough combination, complete combustion and perfect distribution of the hot gases over the boiler heating surfaces. Costs of operation, even though the fuel have a high price in the market, may probably, in the end, be made satisfactory by these practical advantages in the use of this class of fuel. Automatic supply is essential to complete success in the use of fuel. Success has been so far attained in the use of the petroleums as fuel that they are adopted by the makers of steam-automobiles generally, and the fact of their successful use to-day may be taken as indicating a probability that they will prove the ideal fuels of the coming years with the automobile.

Assuming 10,000 *B. T. U.* obtainable for storage in the boiler from a pound of fairly good coal, it would represent 7,780,000 foot-pounds of work. If all transformed into work in one minute, it would produce 232.7 horse-power; if distributed over an hour, it would measure nearly 4 horse-power. If distributed over a day's work of ten hours, of which four-tenths was occupied in active work, the remainder in awaiting the completion of the work of loading by other power, as is not unusual in working horses, the equivalent of precisely one horse-power for the day would be secured. In fact, however, the average power of the horse is less than the engineer's horse-power of 33,000 foot-pounds per minute, 1,980,000 per hour, and a single pound of coal is fairly equivalent, in stored energy, to more than the average day's work of the average horse.

The 10,000 *B. T. U.* of the pound of coal, as stored in the boiler, will under favorable, but very usual, conditions of steam-making, produce about ten pounds of steam, and thus each pound of steam stored is the equivalent of about one-quarter of a horse-power, and, if perfectly utilized in an engine capable of entirely converting it into work, an engine of efficiency unity, about 2½ pounds of such steam per hour would represent the storage of the equivalent of one horse-power; as would about one-fourth of a pound of coal of the assumed quality, utilized to the extent assumed. In fact, the best coals store 15,000 *B. T. U.* and the equivalent of 11,670,000 foot-pounds and of nearly 6 horse-power-hours, per pound. About forty times such amount is stored in a cubic foot; for the pound of coal only occupies about 43 cubic inches, a pint and a half, a volume no greater than a large man's fist, as Col. Meier has put it. Thus a cubic foot of coal stores from 400,000 to 600,000 *B. T. U.* of heat-energy, *available,* or actually potential in the best varieties according to quality, and the equivalent of about 160, or 240, horse-power-hours, minimum and maximum, respectively. The stored energy of a pound of best coal would raise a ton about 5 miles, or its own weight 10,000 miles.

Utilized heat-energy, unfortunately, never amounts to more than a small fraction of the stored energy of the fuel. The largest and best steam-engines convert only about one-fifth of the heat brought to them by the steam into work and thus avail themselves of but, at most, about 3,000 *B. T. U.* per pound of coal, requiring at least one pound of fuel and 12½ pounds of steam per horse-power-hour. Mr. Corliss' best practice with the simple condensing engine of his time, exhibited an efficiency of 12 per cent. and demanded 20 pounds of steam and about 2 pounds of coal per horse-power-hour, and, non-condensing, 30 pounds of steam and 3 pounds of best coal, with largest engines. Small engines of fairly good construction now require about 50 pounds of steam and 5 to 6 pounds of fuel, having an efficiency of not far from five per cent.—wasting ninety-five per cent. of the potential and stored energy of the coal. Thus the energy available diminishes from a small fraction, at most, with the best of our engines, to this insignificant quantity in common practice. But our smallest engines are even worse, and the direct-acting steam-boiler feed-pump, for example, consumes, often, 100 and sometimes 200 pounds of steam, 10 to 20 or more pounds of fuel, per horse-power-hour, and the steam-automobile probably rarely uses less than the lower of the two figures. The pound of fuel thus represents available energy in amounts, small at best, enor-

mously variable with the character of the engine employed and its size, and thus stores but from one-tenth to one-twentieth horse-power-hour in small engines and not above one horse-power-hour in the best of modern constructions, even on a large scale, the equivalent of from three-quarters of a kilo-watt to 15 kilo-watts; the lower being the figure found usually for the small engines of all sorts, including the automobile.

With oil-fuel and the petroleums, generally, storing about 20,000 *B. T. U.* per pound, weighing 45 to 55 pounds per cubic foot, storing over 15,000,000 foot-pounds per pound, averaging not far from 750,000,000 foot-pounds per cubic foot, 7½ horse-power-hours per pound, 375 horse-power-hours per cubic foot, about 5½ and about 270 kilo-watts—the case is somewhat better as regards storage, but not at all improved in the matter of utilization of the heat stored in the fuel.

The Steam Automobile has very obvious disadvantages, despite its evident success on the railway and with the traction-engine, and notwithstanding the facts that it was successful in a remarkable degree in the early half of the nineteenth century and that builders are perfectly familiar with proper proportions and methods of construction for every one of its unnumbered earlier applications. Its steadiness and reliability, when properly employed, its handiness in starting, stopping, reversing and for forward and backward movement, its convenience of adjustment to any desired change of speed, and in all emergencies, and its moderate cost of operation have made it one of the principal, if not the leading, competitor in a great struggle for a mighty prize. The necessity of carrying the usually undesirable steam-boiler under the vehicle or behind it, close to the occupants in any event, the requirement of a skilled operative, the discrimination against it through long-standing legislation, and its complication, and especially, perhaps, its liability to give trouble from the presence of sediment or incrustation in the boiler and from corrosion of the latter, have been, on the whole, a serious handicap. In commercial work, the automobilist may perfectly well be a skilled mechanic and engine-driver; but for the common type of light and speedy automobile, for long routes at high speed and for passenger or pleasure traffic, these objections become important.

A very light, yet substantial, engine, built of the best of material and in well-chosen proportions, with, perhaps most important of all, a system of automatic lubrication of absolute reliability, presumably by some method of flooding all journals continuously, a simple and durable apparatus, easy of manipulation, is the desideratum in this direction.

The boiler must be light, yet extensive of heating surface, and with every square-inch of that surface effective in heat-absorption. It must be made with a high "factor-of-safety" and not only comparatively safe against accident, but so constructed that, if accident occurs, it shall not endanger the occupants of the vehicle. Safety against incrustation or sediment is a primary requirement and this means, usually at least, only the use of a pure water, and this, in turn, compels the adoption of some system of condensation in limestone countries and wherever rainwater cannot be had, if this risk of injury to the boiler is to be quite eliminated. A large extent of very small-sized tubes seems the only construction by which boiler-power can be concentrated and some form of water-tube would seem to be the ideal. The early automobilists, Gurney and Hancock and others, employed such constructions, but the boilers of our later steam-carriages have commonly been of the "shell" type, with fire-tubes.

With steam-carriages, the load of fuel and of water may prove objectionable on long routes; yet they have a fine record, beginning in the "early thirties," for long-distance as well as short-line operation. Copper shells and tubes are used, with advantage, probably, to some extent, in promoting rapid transmission of heat; but copper is a treacherous material, must be used very cautiously. Oil is now generally used as fuel.

The power-transmission between steam-engine and carriage-axle is most usually a simple chain and sprockets, with a differential gear on the axle. Automobiles of this class have been built in considerable numbers, and have done some admirable work. In some, the running parts of the engine and the carriage and their journals and sliding surfaces are not as perfectly protected from dust as they should be. The engine, particularly, should be enclosed in an air-tight and dust-proof compartment. Durability must not be sacrificed, as has actually been very often done, to lightness, if the vehicle is to come into general use for other purposes than those of a simple racing machine—for such purposes as, only, can yield continuous and profitable returns on a steady and permanent business.

It is perfectly possible that the cost of operation of the "locomobile" may be, by proper designing, construction and operation, made very moderate. I have under my hand, in fact, a report upon a large "locomobile" of which a trial was made abroad, twenty years ago, as reported in the *Bulletin de la Société de Mulhouse*, January, 1880 ("locomobile," in French, meaning a traction-engine), in which the consumption of fuel was but one kilogram of combustible per effective horse-power-hour. It was,

however, a large machine and developed about 80 indicated, 70 effective, horse-power. It consumed 7.3 and 8.5 kilos (16.6 and 18.7 pounds) of dry steam per horse-power-hour; which is a fine performance, even for a first-class stationary engine of similar power. In Great Britain, some of the best records have been made by "agricultural steam-engines" of 10 to 20 horse-power. Professor Alden has done wonderful work with his little compound engine. We need not despair, therefore, of securing economy in the steam-engine employed with automobiles. Chief Engineer Croker and Commissioner Scannell, we are told, report most satisfactory efficiency and good economy as the result of their experience with the steam-automobile.

For commercial transportation, the steam-wagon has been found, according to Herschmann, to possess essential advantages, thus:

"(1) It has the greatest load and mileage capacity and radius of action.

"(2) Its operation is independent of charging stations and supplies necessary for the operation of the wagon can be easily procured and taken aboard quickly."

The variation of the expense of operation with size which finally become prohibitive in the electrically driven wagon reverses with steam. The danger, and the injury to fine classes of goods transported, from the odors and vapors of the internal combustion engine are absent with the steam-carriage, and the limit of daily delivery is greatly extended by its employment on a large scale and with a fairly high rate of speed.*

The Light-weight Steam-Engine finds its most extraordinary development, to date, in the department of aëronautics. In 1868, at the Aëronautical Exhibition at the Crystal Palace, London, Mr. F. J. Stringfellow took the prize for such an engine and boiler with a machine rated at from 3 to 4 horse-power, but actually developing, probably, between 1 and 2, and weighing but 13 pounds. This machine, lately bought by Dr. Langley, is now to be seen at the National Museum of the Smithsonian Institution, Washington. The boiler is water-tube and the engine direct-acting. Giffard, in 1852, built a balloon-engine weighing 110 pounds per horse-power.

French dirigeable balloons by Dupuy de Lome, Tissandier, and Renard & Krebs, years ago, developed power, the first muscular at the rate of 1,800 pounds per horse-power, the second and third by storage batteries—"*accumulateurs*"—at 300 for two and a half hours, and at 70 pounds per horse-power for two

* Trans. Am. Soc. M. E.; May, 1900; No. 853.

hours only, and yet attained what, in their time, was thought a marvellous success. Gas-engines were used by Hanlein at Brunn, in December, 1872, both reciprocating and rotary, and the weights reported were about 200 pounds per horse-power. Professor Langley has brought down the weight of the steam-engine for such work to less than 3 pounds per horse-power, apart from the boiler, for a single horse-power, and presumably to lower weights for higher powers. Mr. Hargrave has produced engines weighing 10 pounds and Hiram Maxim's famous engine, with boiler and accessories, weighs about 8 pounds, per horse-power, and develops about 300 horse-power, maximum. Aviators have stated their belief that 15 pounds per horse-power is a practicable maximum. H. M. S. Viper produces 10,000 horse-power on only 12 pounds weight of engine per unit, for engine alone. The indications seem to be that the birds often weigh considerably more than this, if not as high, in some cases, as 25 pounds per horse-power. It is supposed that military balloons, built by the army officers of European establishments, have attained speeds of 20 and 25 and possibly 30 miles an hour, in still air, with both steam and electric propulsion.

Fuel must be reckoned with, however, in all forms of artificial as well as natural propulsion. The steam-engine usually demands, in these small sizes, not less than 10 pounds of coal or 6 or 7 of oil per horse-power-hour. The bird stores a day's provision or less in a single meal, on long flights, using reserves of fat. Mr. Maxim has actually, as he tells us, reduced the weight of fuel for his engine to one pound of naphtha per horse-power-hour and that is most encouraging. He thinks internal-combustion engines should ultimately reduce weights considerably below those of steam-engine and boiler.

After Boulton & Imray's proposed gas-engine for aëronautic purposes, in 1868, and that of Hanlein in 1872, Selden devised a machine of that class in 1874 or thereabouts and continued his experiments and investigations for a long time, if not to date. The first of all gas-engines, in fact, Brown's of 1823, was designed for the propulsion of automobiles, as the inventor tells us, and it is said was actually thus employed.

The limit of weight, in the case of the steam-engine, has thus been most nearly approximated in the construction of the steam-machinery of the torpedo-boat and of the aërodrome. The former amounts, in good practice, usually, to about 100 pounds of displacement—boat and contents—per horse-power of machinery. Maxim's steam-engine, of 300 horse-power, apart from its boiler,

weighs 300 pounds very nearly, or a pound per horse-power. Langley has certainly improved on this considerably and may perhaps be able to bring down the weight by, of course, enormously costly construction and material, to perhaps a half-pound. In marine work, Mosher has reached as little as 4½ pounds, and the "Turbinia" is stated to have a weight of engines of but about 3 pounds. Boilers at a minimum weigh about 10 pounds per horse-power of attached engine, in this class of work, and often rise to 20 or more. Torpedo-boats generally range between 40 and 50 pounds per *I. H. P.*, total, of which about two-thirds is boiler and one-third engine. Mosher's radical practice, by peculiar and ingenious methods of design and construction, brings the total down to about 15 pounds, working at powers ranging from 1,000 horse-power upward. The automobilist's steam-engine should approximate the weight of that of the aëronaut and aviator and his boiler should be the lightest of "sectional" or "safety" types, and with moderate use of fuel and water.

We may perhaps reasonably hope for engines of the multiple-cylinder type weighing less than 5 pounds per delivered horse-power, boilers not exceeding 10 pounds for the same unit of power, and a fuel-storage not exceeding 2 pounds per horse-power-hour of operation on the road in the future.

Weight of boiler, other things equal, is determined by the area of the heating surface, and the required area of heating surface is determined, in turn, by its effectiveness. Double the effectiveness of average heat-absorptive power for the boiler and its weight is at once halved. Many stationary boilers require, or are thought by their builders to require, not less than 15 feet to the conventional horse-power; others are allowed but 7½; while, in marine practice, boilers actually furnish, frequently, a horse-power from 2 square feet of heating surface. All depends upon the efficiency of the unit of area, and this depends upon its form, disposition relatively to the boiler itself, and position relatively to the impinging gas-currents and, possibly considerably in many cases, on the direction, as well as velocity, of the impinging currents, both of gas and water. A closely subdivided heating surface, with the hot-gas currents searching every inch of its area and the circulation within it finding access to and steady flow over every point of its interior, gives maximum results in condensation of volume and weight, with highest economy for a given size. Fire-tube boilers must probably ultimately retire definitely from this field and give place to the water-

tube variety as, only, meeting the requirements, at once, of safety, lightness and power, combined with economy.

"Dry boilers," flashing the water into steam, charge by charge as demanded for use in the engine, the "*vaporisation instantanée*" of the French engineers, has been the obvious limit of reduction of the quantity of water present in the generator in the endeavor to secure power, lightness and adaptability to momentary requirements of the motor. The "safety-boilers" of Barlow, Trevithick, Voight and John Stevens and their successors have all been devices more or less approximating this limit and the demands of the automobile have accentuated the requirements of the marine engine and locomotive and steam-carriage builders of the early half of the nineteenth century. The work of Brayton and of Babcock, still earlier, and of the pioneer, Robert L. Thurston, in 1825 or thereabouts, and of the French inventors, Boutigny and Buisson and others, vaporizing water drop by drop and charge by charge, as required by the engine, has been carried to its limit, in our time, by Serpollet, who regulates the speed and power of his engine by the feed-water supply and makes an empty hot boiler his energy-storage system, when his engine is stopped.*

By compressing a tube of circular section until it becomes completely flattened and its interior a space of capillary thickness, he secures a very peculiar and yet, as is testified, effective method of vaporization. In this space, one-tenth of a millimetre in thickness, heated to about 300° C. (572° F.), the pump forces water at a rate determined by the operator and the vapor produced is capable of developing a quantity of work in the engine proportional to its own quantity and thus to transfer energy by thermodynamic transformation from fuel to engine-shaft, as needed; regulation being performed by adjusting the volume of water thus supplied. Solid matter in the water is reported to be driven through the capillary space in minute subdivision and the material of the tube is not either incrusted or corroded and it actually serves, according to the statement of M. Lesourd, as a solid lubricant at the engine.

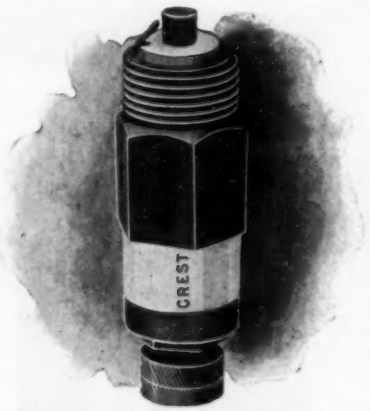
* Le Genie Civil; 1889, p. 283.

(*Fourth paper next issue*)

Crest Indestructible Sparking Plug

THE Crest Manufacturing Company, of Cambridgeport, Mass., manufacturers of Crest Motors for automobiles, are putting on the market a radically new design of sparking plug that is not affected by heat and expansion, and is unbreakable.

After a considerable expense in experimenting with the best porcelains of foreign manufacture they have, through the assistance of a well-known chemist, discovered a new material that is unbreakable by heat or expansion. They have had these sparking plugs in use for a long time on their motors without any reports of failures, and have decided to introduce them to other manufacturers and users of other makes of motors.



It is well known that the sparking plug is a delicate piece of mechanism and gives considerable trouble, and the failures of motors can, as a rule, be traced to the failure of the sparking plugs, and for this reason all automobilists are compelled to carry one or two spare sparking plugs in their kit.

Although the jump spark method is the most largely used to-day on account of the simplicity, it would be universally used in preference to the contact and wipe spark methods if it was not for the troubles of the sparking plug with its liability to crack with the intense heat of the motor, short circuiting the secondary circuit.

The material used in this plug is a perfect electrical non-conductor, and does not expand under intense heat. It is a tough material, not being brittle like porcelain.

The sparking plug, as shown in the cut, consists of a shell of steel having a thread at one end to screw in the orifice of the chamber of the motor.

The sparking plug proper consists of a slight cone of this new material, which is inserted in the steel plug. This cone fits

tight in the shell, making a gas-tight joint, without packing, unlike all other forms of sparking plugs, as they use packed joints which, in the hands of unskilled persons, are apt to cause failure in the working of the motor. Through this cone a wire is passed terminating at the bottom of the plug with an enlarged head. A platinum wire is inserted in the body of the steel shell, the spark jumping across between the two points.

The plugs are sold singly or in lots of 25 to 100 to the trade. Directions go with each plug.

The Eldin Lubricator

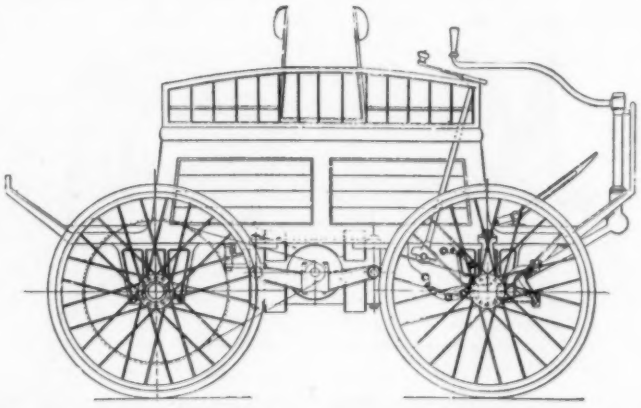
THE inconveniences attending the use of separate oil-cups for the bearings of automobiles have induced some manufacturers to arrange the cups in a series and to conduct the oil to the desired points by copper tubes.

A French inventor, M. Eldin, has devised a very simple improvement upon this method, which consists in employing a single lubricator having the capacity of eight cups. Eight feed tubes are provided to conduct the coil to the bearings. The lubricator is made of aluminium and is especially designed for use on the Peugeot carriages; it is also applicable to all other automobiles.

The plunger within the lubricator is forced down by turning the hand wheel shown in the engraving. The new lubricator evidently possesses the advantage of simplicity over the system hitherto used.

The First Electromobile

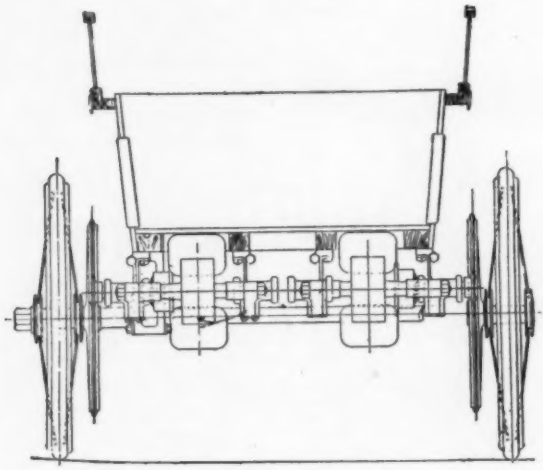
IN 1882 Mr. T. Partey exhibited at the Coalbrookdale Institute a number of Siemens-Edison incandescent lamps fed by a storage-battery current, according to a system which he had devised. In the same year he discovered that nitric acid assisted the "forming" of the battery-plates, and took out a patent for the use of the acid for that purpose. By a remarkable coincidence it happened that the same improvement was claimed in patents granted to H. Parker and Gaston Planté. At almost the same period Paul Bedford Elwell of Wolverhampton entered into partnership with Parker and formed the firm of Elwell and Parker, for the manufacture of accumulators and the installation of electric plants. Soon after Faure and Sellon invented the



paste battery, which soon superseded the Parker-Planté accumulator. The firm of Elwell and Parker transferred its business to the Electric Storage Power Company. Since that time little improvement has been made in the construction of accumulators, although, within the past three years, inventors have endeavored to lessen the weight of the storage-battery and at the same time increase its motive force. In 1884 Elwell invented and built an electric carriage, built on the general lines of the four-wheeled hansom, with the exception that the driver's seat was located in and not behind the vehicle. The springs were elliptical in form;

the wheels were of wood, iron-tired; the brake was operated, as in an ordinary vehicle, by means of a pedal; and at the rear axle an auxiliary hand-brake was arranged.

This axle resembled that of a tricycle and had a differential gear. In the centre, mounted in a metal-casing, was a series of small motors provided with rectangular magnets. The normal speed of these motors was 1,500 revolutions per minute; and the power developed was transmitted directly by means of worm gear and a flexible coupling, both at that time new inventions. The worm-gear comprised a coarse tooth-ribbon, and the worm-wheel, a number of pins, each provided with a small roller, so arranged as to correspond with the divisions of the worm. The movable



connection permitted every possible movement between the motor and the gearing on the axle.

The battery-cells were twenty-four in number, weighed about 660 pounds, and were disposed in the rear of the carriage-body. The cells were arranged in series, and resistances were employed whereby the driver could vary the speed of the vehicle.

At that time English laws were almost Draconian in their severity upon mechanical vehicles. Automobiles were looked upon as road locomotives and their speed limited accordingly. It was therefore impossible on the first trial of the carriage to attain a speed of more than 5 miles per hour. The vehicle ran smoothly enough until a heavy grade was encountered; the

worm-gear would not stand the strain; and the vehicle came to a standstill. The difficulty was, however, soon overcome, and the carriage fully realized the hopes of its inventor.

The electromobile was afterwards improved and kept at Elwell's residence in the country. It was finally brought to London, to be shipped to Paris. But the vessel sank and with it the electric carriage. The ship was afterwards floated and the vehicle recovered. The motor and gearing were sent back to Wolverhampton to serve other purposes. Thus ended the career of the first English electromobile.

Soon after Mr. Ward endeavored to build motor-omnibuses, and in 1890 ordered a vehicle of this class from the Elwell-Parker Company. This first omnibus, although quite respectable in appearance, was very cumbrous, like most of Ward's contrivances. It is said to have weighed, fully loaded, as much as 40,000 pounds! After a series of trials, the London Electric Omnibus Company was founded, with Mr. Ward as its technical advisor. Large sums were spent; but the undertaking did not prove successful. Nevertheless, Mr. Ward deserves the credit of having built the first electric omnibus.

In 1896 the new street railway law was passed; it was followed by various improvements in motor-vehicles. Mr. Bersey was the first man to receive a police license for an electric cab.

The Daimler Freight-Wagons and Coaches

THE exhibit of the Daimler Motor Company, of Cannstatt, at the International Automobile Exposition, held at Berlin during the month of September, 1899, embraced a wagon for the carriage of beer barrels, belonging to the Bohemian Brewery, and one of the Company's motor coaches.

The Daimler freight-wagons are provided with motors of from 4 to 16 horse-power, the latter of which have four cylinders.

Fig. 1. The Daimler Motor Co. Coach

The consumption of gasoline in the motors is regulated automatically and according to requirements. The gasoline reservoir, which is placed in a protected position, has a capacity sufficient for a run of ten hours without refilling. The cooling of the motor is effected with water, of which only a few quarts a day have to be renewed.

In the coach there is a heating arrangement which serves for keeping the feet warm in cold weather. Power is transmitted to the driving wheels through the intermedium of the Company's patent impulsion gearing. The vehicles can be driven at four different speeds, which, in the freight wagons, reaches 6 miles, and in the coaches may be changed from 3 to 15 miles an hour. To this effect, the vehicles are provided with a quadruple speed-changing gear, which is operated by the simple manipulation

of a hand lever. The arrangement adopted is such that the changes of speed are effected while running, and that one speed must first be completed before another can be entered upon. The steering is done through a hand lever and steering rod that acts upon the fore-carriage.

The vehicles are provided with a hand and a foot brake, the latter of which, the more effective of the two, serves for braking the vehicle or bringing it to a standstill; while the former is used only for reinforcing the operation of instantaneous stoppage at the end of a trip.

The freight wagons are capable of climbing gradients of 12% and the coaches those of as high as 15%.

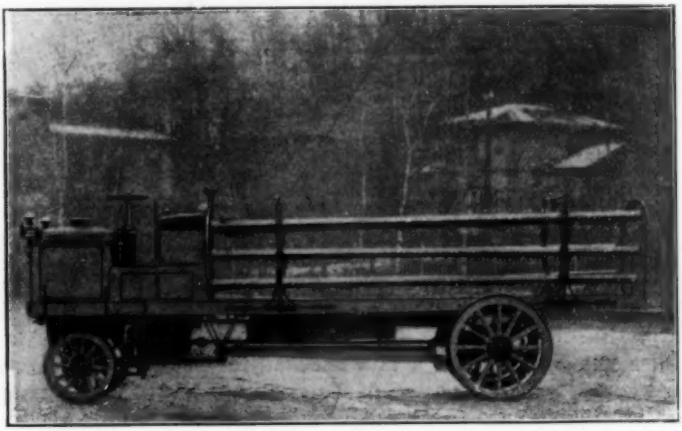
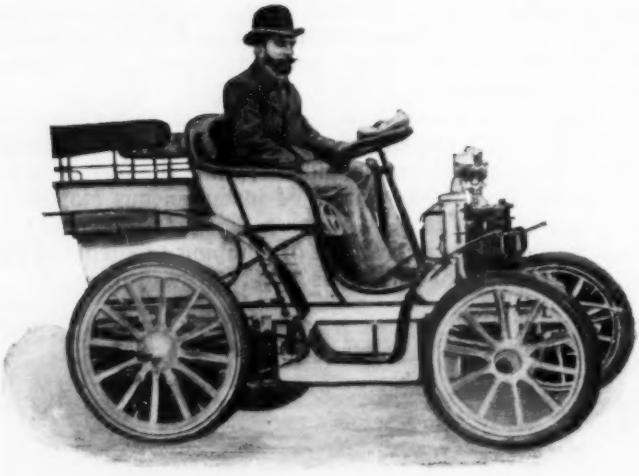


Fig. 2. A Daimler Motor Co. Beer-wagon



The Bardon Carriage

THE subject of the accompanying illustration, reproduced from a photograph, is one of the small types of the Bardon carriage, manufactured by the Société d'Automobiles et de Traction. The mechanism includes a 4 H. P. motor cooled by a circulation of water and provided with a single cylinder in which move simultaneously and in contrary directions two pistons actuated by the explosion that takes place in the single combustion chamber.

The economical benefit of such an arrangement, in which but a small quantity of gasoline is used and the total number of valves is limited to two, will be immediately seen.

The motion of the two pistons is transmitted through bevel wheels to a single shaft arranged parallel with the cylinder.

The shaft is provided with a friction cone that permits of putting it in connection at will with the shaft that carries the differential gear and actuates the hind wheels through the intermedium of chains.

What is particularly interesting is the ingenious arrangement of the friction cone, which is double, and against which bear two pieces that transmit their motion to the shaft of the differential through the intermedium of a socket and the change

of speed gearing. Owing to such an arrangement, all lateral thrusts are prevented. This is one of the reasons why high speeds are obtained in the Bardon carriages with a minimum output of gasoline.

The carriage under consideration is provided with three speeds; and the reversal of its motion is obtained by means of a spur gearing, which, when the vehicle is running forward, is thrown wholly out of engagement.

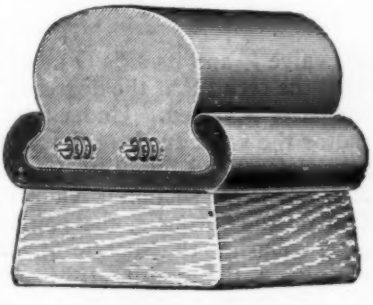
The igniting is done electrically. The steering is effected through the intermedium of an inclined hand-wheel, alongside of which are arranged the levers for changing the speed and regulating the ignition.

The brakes, which are very powerful and three in number, are placed, one of them upon the differential gear and the two others upon the hind wheels.

The type of carriage which we have just described, and which weighs but 1,430 pounds, has already covered more than three thousand miles, and has easily climbed all varieties of up-grades with four passengers.

The S. & T. Tire

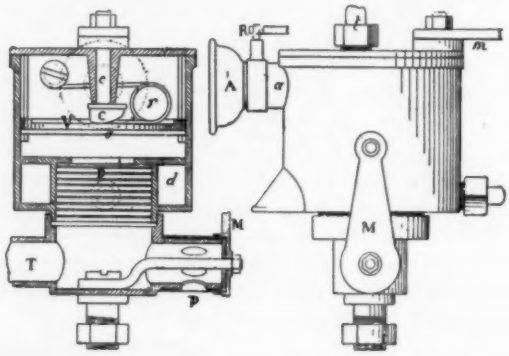
The accompanying cut shows the form to which the Shrewsbury and Talbot Cab and Noiseless Tire Company have brought their rubber tire. The main wires are surrounded by spiral wires which prevent the former from cutting the rubber. The section of the rim, in conjunction with the form of wiring, show that the firm are fully alive to the importance of taking all precautions to prevent the tire from slipping off. A further device, which they are about to make use of, will have the effect of preventing the tire from slipping round the rim when the wheel is braked, and will at the same time help to hold it on. The attempt to fit omnibus wheels with two tires each, abreast, proved a failure, but the Shrewsbury and Talbot Company are making heavy single tires for this purpose.



The Raymond Carbureter

THE accompanying illustrations show a new form of carbureter which has lately been put on the market by M. A. Raymond aîné, of 128 Rue du Bois, Levallois-Perret (Seine), and which is claimed to be the smallest device of the kind so far introduced. It is being made in several sizes, Figs. 1 and 2 showing a carbureter for small motors of from 1 to 2 horse-power. The main feature of the apparatus is a kind of balanced valve *V*, which moves around an axis *O*. This valve carries a pointer which engages with the lower end of the petrol admission pipe *t* (Fig. 2).

The pointer is not seen in Fig. 1, it being hidden behind the spindle *c* of the handle *m*. A helicoidal cam *C*, of which the shaft *c* is maneuvered externally by means of the lever *m*, removes



the valve *V* and its axis *O* more or less from the spirit inlet pipe, with the result that the degree of engagement of the pointer with the latter is varied. Under the effect of the suction stroke of the motor the valve turns on its axis, and the pointer falls, allowing a predetermined quantity of petrol to pass into the carbureter. As soon as the suction is ended the valve is brought back to position by the spring *r*, the pointer consequently closing the inlet pipe. During the suction stroke air is also drawn in through the pipe *a*, the mouth, *A*, of which is provided with wire gauze to prevent the admission of any dirt or dust. The quantity of air admitted is regulated by the valve *R*. The petrol, as soon as the valve *V* moves, falls thereon and meets with the air, a thor-

ough mixture being formed on the passage through the series of wire-gauze discs *D*. To assist in the carburation, a part of the exhaust gases from the motor are made to circulate in the annular space *d*. The necessary additional cool air, to form a good mixture, is drawn in through the openings *P*, regulated by the handle *M*, the explosive mixture then passing to the motor along the pipe *T*. To start the motor, the valve *R* is closed and the handle *m* moved over about a third of its movement, the electrical ignition being retarded. The motor once in operation, the quality of the mixture is regulated as desired by the levers *R*, *M*, and *m*. It is claimed for the device that it is regular in operation, notwithstanding the jolting caused by uneven roads, and that the regulators are instantaneous in their action.

Dunlop Non-Slipping Tread

The wretched greasy condition of the roads which has lately been the order of the day has tended to confirm the opinion that motor cycle tires, like ordinary cycle tires, are none the worse for being provided with a non-slipping tread. Up to the present the only tire firm we know of that has recognized the importance of this point is the Dunlop Company, whose tires for motor cycles can be had with either smooth covers or non-slipping covers, as preferred. The non-slipping pattern which we illustrate is a modification of the Welch type, which is familiar to every cyclist. In addition to the basket-work design there are small longitudinal ridges which help to prevent any side movement. It is possible that these small ridges may in time get worn off, but even in that case the deeper basket pattern would still remain. Only the other day we heard of a nasty mishap with a motor tricycle, due to side-slip, which might not improbably have been avoided had non-slipping tires been used.

New Accumulators for Automobiles

The Cruto Battery

IN the Cruto battery, the support of the positive plate is formed of a solid cast plate provided in the direction of its width with projections of rectangular cross-section, which are flush with a frame surrounding the entire plate. These projections are partially beaten down so as to produce hooks. The space between two successive series of projections forms a kind of trough 2 mm. wide and 2 mm. deep; closed at each end by the vertical posts of the frame. There are on each face of the plate 49 partitions each provided with 42 hooks. The frame which surrounds the plate has a width of 4 mm. and a thickness equal to that of the plate, *i. e.*, 6 mm. The upper horizontal bar of the frame projects beyond each of the vertical side posts to a distance of 12 mm. The connecting-bar is distant about 3 cm. from one of the vertical edges.

The support of the negative plate is even more intricate than that of the positive. It is composed of a cast grid, the openings of which have a square section about 5 by 5 mm. and the separating members a rhomboidal or lozenge-shaped section, two edges being flushed with the frame surrounding the plate and the two other edges constituting the borders of the grid openings. In each plate there are 399 of these openings. The thickness of the frame as well as of the plate is 5 mm.; its width is 5 mm. for the horizontal members of the frame, and 4 mm. for the two vertical posts. At each corner of an opening, the edges of the lozenge-shaped separating-bars are bent up to form four small hooks. The connecting-bar for the two elements of the battery is located as in the positive plate; and the upper horizontal bar of the inclosing frame projects in like manner.

The paste completely covers the hooks of the positive plates, so that only the outer frame is exposed. The paste of the negative plate likewise covers the grid; and the hooks are embedded so as to be flush with the inclosing frame.

Plates of like polarity are soldered to a bar carrying at its middle a rod constituting one of the poles of the element.

The plates are separated by perforated and waved ebonite partitions, held in the center of the 6 mm. space between adjacent

plates by means of small blocks on the vertical edges of the partitions and by means of lugs distributed over the rest of the surface, so as to permit the ready circulation of the electrolyte.

The cells are made of ebonite and are 5 mm. in thickness. At a height of about 7 cm. from the upper edge, two of the opposide walls are bent out so as to form a shoulder on which the lateral prolongation of the plate-frames rest.

An interesting method is employed for supporting the cells in groups. The shoulders of the cells are supported on rubber blocks; while similar blocks are arranged between the walls of the cells and of the entire battery-box and between the various cells constituting the battery.

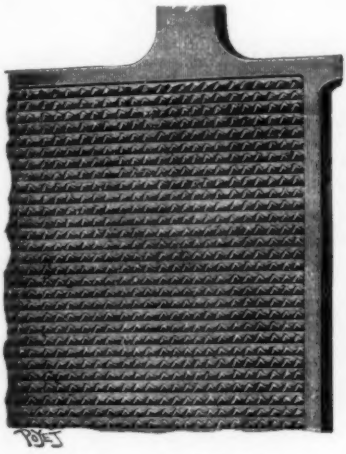


Fig. 1. Positive Plate

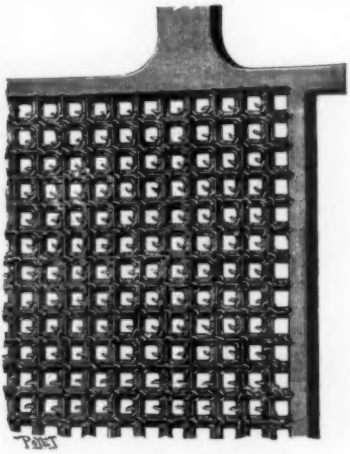


Fig. 2. Negative Plate

POSITIVE PLATES

Number	7
Dimensions in centimetres:	
Height	15.8
Width	14.2
Thickness	0.6
Weight in kilograms	0.96
Weight of the frame in kilograms	0.7
Weight of the active material in kilograms	0.26
Section of the frame in square millimetres	27.00
Section of the connecting-bar in square millimetres	84.00

NEGATIVE PLATES

Number	8
Dimensions in centimetres:	
Height	15.8
Width	14.2
Thickness	0.55
Weight in kilograms	0.9
Weight of the frame in kilograms	0.64
Weight of the active material in kilograms	0.26
Section of the frame in square millimetres	25.00
Section of the connecting-bar in square millimetres	84.9
Space between plates in millimetres	6.00

CELLS AND APPURTENANCES

Dimensions in centimetres:	
Height	25.5
Length	20.5 and 16.5
Width	18.5
Weight of the cell in kilograms	2.0
Weight of the insulating separating members of the plats in kilograms	0.28

ELECTROLYTE

Weight in kilograms	4.0
Volume in cubic decimetres	3.3
Density:	
End of charging	1.25
End of discharge	1.21
Total weight of the complete element in kilograms	21.20

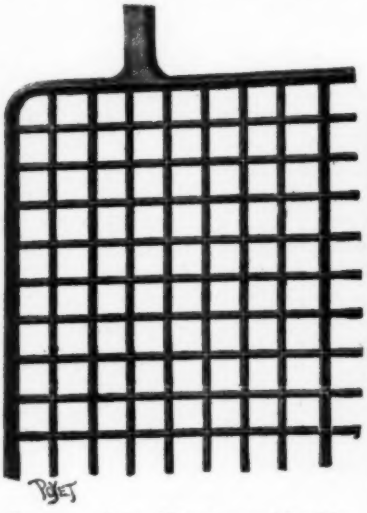
The Lagarde Battery

The Lagarde accumulator is of the pasted type in which a leaden grid is employed.

The support of the positive and negative plates is formed of a frame reinforced by two arms at right angles to each other and serving to maintain the rigidity of the frame. These arms divide the plate into four panels each subdivided into 88 square cellules 8 by 8 mm. in area. The partitions forming the cellules are completely covered by the paste. The bar connecting the two plates

is cast in one piece with the frame and is located about 3 cm. from the end. The cross-section of the cellule partitions is lozenge shaped, the edges serving to retain the pellets of active material. The paste is formed with no hole to facilitate the circulation of the electrolyte.

The plates are connected by means of a leaden bar. This connecting-bar is provided with a rod which projects through the cell. In order to prevent the peeling-off of the active material, the positive plates are wrapped in a sheet of parchment paper and then covered with a rubber bag which serves the dual purpose of preventing the peeling of the active material and of insulating



Support of the Negative and Positive Plates

Positive Plate

the plates from one another. The negative plates are uncovered. The positive and negative plates are pressed against one another so as to reduce the intermediate space to a minimum.

The quantity of electrolyte which is contained in the cell is less than the weight theoretically necessary. The weight of the sulphuric acid used is 360 g. at a density of 1.274 at the end of the charging.

The inventor has lavished the utmost care upon rendering the retaining vessel water-tight. The cell is closed by a cover which is adapted to rest on a shoulder formed within the walls of the cell. This cover is formed with a notch which receives a band

of rubber pressed against the cover and the wall of the cell by a frame which is held in place by insulated pins.

The connecting-rods extend through the cover, for which purpose threaded holes are provided in which a piece of ebonite is screwed, carrying a rubber tip at its lower end. These ebonite pieces are laterally recessed to receive a small brass bar which serves as a current feeder. The bar passes through a hole in the connecting-rod. Ingenious as the method of rendering the cell water-tight may be, it cannot be denied that the separation of the parts is thereby rendered extremely difficult.

POSITIVE PLATES

Number	6
Dimensions in centimetres:	
Height	20.
Width	15.5
Thickness	0.6
Weight in kilograms	1.08
Weight of the support in kilograms	0.22
Weight of the active material in kilograms	0.86

NEGATIVE PLATES

Number	7
Dimensions in centimetres:	
Height	20.
Width	15.5
Thickness	0.5
Thickness of the extreme plates	0.4
Weight in kilograms	0.950
Weight of the support in kilograms	0.185
Weight of the active material in kilograms	0.765

CELL

Dimensions in centimetres:	
Height	28.
Length	16.
Width	11.
Weight in kilograms	1.4

ELECTROLYTE

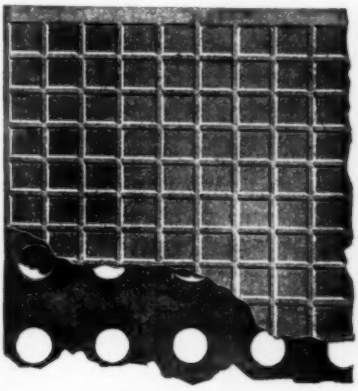
Weight in kilograms	1.4
Approximate volume in $dm.^3$	1.12

New Accumulators for Automobiles

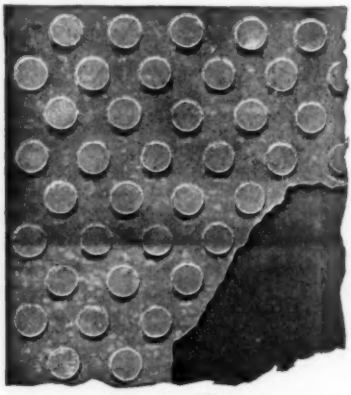
Density:	
End of charging	1.274
End of discharge	1.190
Total weight of the complete element in kilograms	16.00

The Hathaway Battery

In the Hathaway battery, the active material instead of being placed in a frame or grid in the usual manner, is formed in large pellets of the same size as the plate. The positive plate is composed of two similar pellets, between which a metallic conductor is arranged which serves to lead off the current. The parts are held in position by two porous partitions each composed of four



Positive Plate



Negative Plate

small burnt-clay or terra cotta plates, producing a checkered appearance on the outer face. A series of grooves is formed on the other face, running in the direction of the height. The central conductor is a thin perforated sheet of lead, the perforation, however, not being intended to receive active material. The negative plate has no exterior support; or rather the support which serves to hold the active material is formed of substances which disintegrate under the action of the acid. Generally a perforated wooden plate is employed for this purpose.

The surface of the pellets of active material is composed of disk-like projections, formed by the material which fills the holes of the support in which the plate was held during the process of forming.

The cell is composed of ebonite and has two lateral openings or notches from which the connecting-bars emerge. A small vent hole is provided for the escape of the gases.

POSITIVE PLATES

Number	5
Dimensions in centimetres:	
Height	21.5
Width	15.0
Thickness	0.5
Weight in kilograms	1.39
Active surface in dm.^{2}	40.00

Setting of the Plates

Visible surface in dm.^{2}	6.50
Proportion of active to visible surface	6.

NEGATIVE PLATES

Number	6
Dimensions in centimetres:	
Height	21.5
Width	15.0
Thickness	0.5
Weight in kilograms	1.1

New Accumulators for Automobiles

Approximate weight of frame	0.3
Approximate weight of the active material (kilogr.)	0.8
Section of the frame in square millimetres:	
Height	17.
Base and sides	12.
Distance between plates	0.55

CELL

Exterior dimensions in centimetres.	
Height	30.
Length	16.
Width	12.
Weight in kilograms	1.22

ELECTROLYTE

Weight in kilograms	3.
Approximate volume in $dm.^3$	2.5
Density:	
End of charging	1.2
End of discharge	1.18
Total weight of the complete element in kilograms	17.00

The Lindsay Spiral Clutch

THE well-known Lindsay spiral clutches, which are widely used for coupling shafts of all sizes, are beginning to be applied to the automobile. The results obtained are said to be very gratifying. The fact that, unlike most similar devices, these clutches can be made to run in oil and can be completely protected from dust, renders them particularly well adapted to the motor-carriage.

Spiral and its Hooked Lug

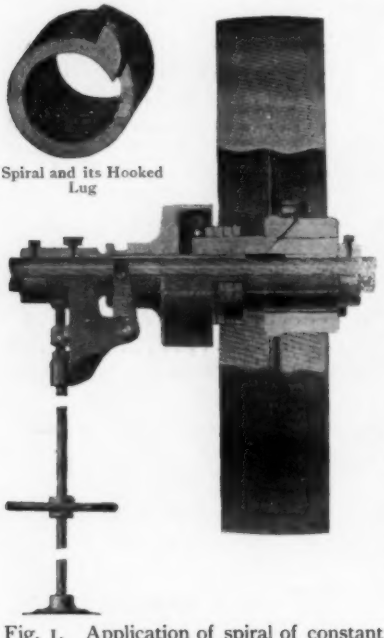


Fig. 1. Application of spiral of constant cross-section to pulley and shaft

There are two general types of Lindsay clutches, differing slightly in principle.

One form consists of a spiral of constant section, coiled in the form of an elastic cone, mounted on a cast cone. The clutch operates at all speeds, even when the shafts are running at several thousand turns per minute.

The second form of clutch is built on the principle of the rope-brake. It comprises a soft steel spiral of diminishing cross-section, coiled about a cast sleeve, keyed on the shaft. The reinforced end of this spiral engages the part to which power is to be transmitted, while the other end is submitted to a progressive tension in order to bind the parts firmly together. The second type is more suitable to the automobile and to machinery which, though running at a low speed, transmits great power.

The Spiral of Constant Section.

Fig. 1 of the accompanying illustrations represents a spiral clutch of constant cross-section applied to a pulley.

The spiral is loosely coiled about a cast, hardened cone, to

which the pulley is keyed. The spiral is formed at its end with a hook in contact with a transverse rib or flange of a movable plate which can be shifted along the shaft.

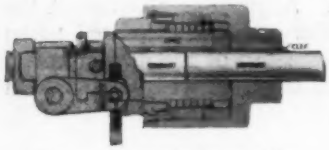


Fig. 2. Two shafts together

The plate is provided with two lugs in contact with the spiral, and two bolts, carrying at their end two members in contact with the spiral. The cone and the spiral should always be well lubricated. When the parts are out of gear, the solid cone turns freely within the elastic cone formed by the spiral. In order to throw the parts into gear, the elastic cone is gently moved on the solid cone. When the elastic cone has reached the end of its travel, it transmits the maximum power which it is calculated to withstand; and the shaft and pulley are bound as firmly together as if they were made of one piece. There is no reaction on the shaft. The clutch can be used on shafts running at any speed and operates without any shock or jar.

If, instead of moving the elastic cone to the limit of its motion, it be maintained in an intermediate position, it will transmit less power, without any relative movement between the two cones, and hence without wear. (The cones, it must not be forgotten, are always well lubricated.) The amount of power to be transmitted can therefore be regulated. If the power exceed that for which the clutch is built, or if the resistance of the driven part exceed the power to be transmitted, the elastic cone will slide on the solid cone, until the resistance has returned to the normal.

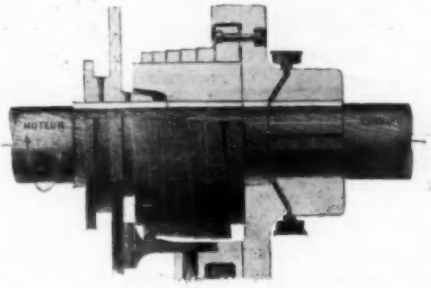


Fig. 3. Spiral of decreasing section applied to two shafts

The driving parts are thrown out of gear by moving the clutch members in a direction opposite that of throwing them into gear. The disengagement is effected gradually and with little effort.

Fig. 2 shows the clutch used in coupling two shafts—an arrangement which will be generally adopted for automobiles. The elastic cone is inclosed in a casing filled with oil, and in this case is fixed, the solid cone being the movable member. The

sleeve is keyed on the driving shaft. By means of flanges the sleeve engages the spiral.. The cone within the spiral, when forced into operative position, turns and drives the power-receiving shaft on which it is secured. Adjustable stops limit the movement of the cone and enable the power transmitted to be regulated. It will be observed that the end of the driving-shaft rotates in a bushing within the solid cone, whereby its position is maintained.

The Spiral of Diminishing Section.

Fig. 3 shows the second type of clutch in partial side elevation and longitudinal section. On the driving-shaft is secured a polished sleeve about which the spiral is coiled. The large end of the spiral is bolted to a second sleeve on the shaft to be driven.

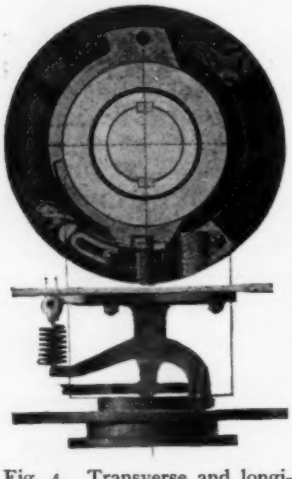


Fig. 4. Transverse and longitudinal sections of clutch with spiral of decreasing cross-section

In inoperative position, the sleeve on the driving-shaft turns freely within the spiral. On the driving-shaft there is also mounted a clutch-plate, secured by long keys, so that it can be shifted by means of a fork.

The operation of the clutch is well shown in Fig. 4. When the plate is shifted, it comes into contact with a three-armed lever, the pivot of which is integral with the sleeve on the shaft to be driven. The small arm of the lever engages the hook on the free end of the spiral and tightens it. The spiral is compressed on the sleeve of the driving-shaft and thus causes the shaft to be driven to rotate.

The parts are thrown into gear progressively, owing to the pressure of the plate on the lever, but are thrown out instantaneously, because the lever is forced back by a retractile spring, whereby the small arm is caused suddenly to release the spiral. A stop limits the motion of the spring and prevents the lever from following the plate too far.

The plate is always in rotation, the lever turns only when engaged by the plate. By means of slides the position of the levers relatively to the hook of the spiral can be regulated.

Henri Vernier.

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Editorial Comment

THE PRODUCTS OF COMBUSTION

SPECIALISTS are at times inclined to laugh at the general public for its ignorance in regard to technical matters and the consequently erroneous conceptions held by many people. There are, however, not a few experts who have sins of their own to answer for in this respect. The fund of human knowledge is so vast that no one person can be expected to have more than a very general sort of information concerning anything outside of the particular province wherein it has been his business to inform himself. Beyond this he may have a knowledge of general principles, but in every special field the knowledge of the details is held in trust for the world by certain "keepers of the keys," so to speak. And in every realm of science each province is thus divided and subdivided. There are, therefore, few experts who can speak with authority concerning anything outside of the division where they are at home.

This fact finds illustration in the field of automobilism. New as it is, there is no man who can speak with confidence concerning the entire field. There are many different problems involved: traction, transmission, vehicular construction, different forms of motive power. Each of these departments has its respective

specialists, and while a well-grounded knowledge in the principles of physical and mechanical science will enable a level-headed person to exercise sound judgment concerning the various problems involved, there are few men who can go beyond this. An expert, therefore, must be exceedingly careful to speak only tentatively, and with due reserve, concerning anything outside of his own domain of knowledge, even though it be closely associated therewith.

A case in point is that of a highly interesting, and in many ways instructive, address concerning the automobile, lately given in London by Sir David Salomons, Bart. Sir David has a high reputation as an authority on the automobile. Discussing the problem of motive-power he very properly said that in the present stage of development it could not well be predicted what would be the best form of power. Yet, concerning the explosion-motor as represented by the forms now in use, Sir David hazarded the curiously extraordinary statement to the effect that should animal-traction in our streets be entirely superseded by petroleum-driven vehicles the inhabitants of our cities would all be poisoned! This is jumping at conclusions with a vengeance, and the assertion betrays a most rudimentary knowledge of the process of combustion.

With automobiles as at present constructed it would undoubtedly be extremely unpleasant and a chronic annoyance for the public to be afflicted with the odor that proceeds from the products of slightly imperfect combustion, for the smell of petroleum-gases is one of the most disagreeable known to human nostrils. But of poisoning there can be no serious talk whatever. Combustion in the average explosion-motor is now remarkably complete. The apprehensions of Sir David were based upon the quantity of carbonic dioxide emitted. This, however, is a mere trifle, and is at once taken care of by atmospheric processes. In the generation of steam the average process of heat-production for the purpose results in combustion very much more defective than in the case of the explosion-motor. In the combustion of coal, for instance, a considerable quantity of carbonic dioxide is set free, yet little trouble is caused thereby, even in the greatest manufacturing towns. The main product of combustion in petroleum-motors is aqueous vapor, formed by the union of atmospheric oxygen with the hydrogen contained in whatever form of petroleum is used—whether gasoline, naphtha or ordinary kerosene. Without this mixture of oxygen and hydrogen, combustion—and consequent explosion or sudden expansion—could not take place. The aqueous vapor thus formed is, of course,

absolutely harmless and at once enters into the atmosphere, contributing to its humidity and returning sooner or later to the earth in the form of rain, snow or dew.

In the explosion-motor the petroleum is actually burnt, just as much as under a boiler for the generation of steam, and therefore serves as fuel in a more direct way. The difference is that its efficiency in the former case is enormously greater, a given amount of fuel producing a far greater equivalent in power. Since petroleum represents one of the most concentrated forms of energy we may expect to see the explosion-type of engine ever increasingly used. The main drawbacks at present to its employment in automobile work are the greater complication of parts than in the steam-engine and the consequent difficulty in handling, and also the limited supply of gasoline available. Inventive progress is rapidly overcoming the former objection and we may expect at no distant day to see the explosion-motor handled by the amateur as easily as the steam-engine. Were the utilization of the explosion-type of engine limited to gasoline and the other volatile grades of petroleum known as "petroleum spirit," the second drawback mentioned would be for the future as increasingly serious a problem as that of complication in construction is a diminishing one. These lighter forms of petroleum constitute a very small percentage of the crude oil, and since the demand has increased enormously and the supply is but little more than stationary the price has lately advanced very considerably. In explosion-motors, however, it is still a sufficiently cheap form of fuel, but where used as a substitute for steam in engines of the expansion type—as in naphtha vapor-launches, where much of it is consumed as "flame-fuel" after its expansion, to produce the continuous-expansion process—the increase in price has become well nigh prohibitory. A gradual increase in price appears to be inevitable, and automobile interests may as well face this fact.

Fortunately, however, the remedy partly lies in the substitution of the heavier grades of oil. With these there is likely to be more trouble from offensive odor, on account of the greater difficulty in securing perfect combustion. Successful kerosene motors, however, are said to have been constructed and it looks as if this problem would be completely solved in the near future. Indeed, an admirable type of explosion engine for the use of kerosene oil has been in existence for some years—so long ago, in fact, that the patents have probably expired by this time. The vagaries of the inventor were responsible for its lack of commercial success and the engines are no longer made. Not a few

continue in use, however, and give excellent satisfaction, being highly efficient, while they have the great additional merit of being controlled, with power and speed perfectly regulated, as simply as a steam-engine or electric motor. In all probability this form of engine would serve admirably in automobile work. The automobile industry may be confident, therefore, that its development will not be retarded by the threatened scarcity of the lighter grades of petroleum. The utilization of the heavier oils will serve as a check upon increase in gasoline prices. The supply of gasoline is sufficient for all present needs; and all existing motors, as well as those to be constructed in the near future, may continue to rely upon the form of fuel for which they were built.

With the utilization of kerosene, however, the factor of safety will be greatly enhanced, for in the use of the volatile grades there is a certain element of danger, though comparatively small. It is likely, furthermore, that the combustion of solid fuel will be adapted to the explosion-engine. Promising experiments are reported in the way of introducing minutely powdered carbon, from either coal or coke, into the explosion cylinder of such an engine, to be consumed with each charge.

Road-Racing

Long-distance road-racing in this country on anything like the French basis is, of course, impracticable. There are no continuous stretches of good road to permit it. In various parts of the country there are relatively short sections of excellent road, much of which would compare favorably with even the French highways. On these, if anywhere, whatever road-racing we have must take place. But here public sentiment steps in and is likely to forbid it, as happened in the Boston suburb of Newton the other day. At Harvard University the automobile has this year been a growing factor in sport, and trials of speed have been pretty common among the possessors of vehicles. The other day a more formal contest was arranged for, to take place on the Newton boulevard, which offered exceptionally favorable conditions for the purpose. The contestants had been given to understand that, although under the ban of the law, such a race would not be interfered with if it took place very early in the morning. Neither would it have been had not some influential citizens got wind of it and made complaint accordingly. The police authorities therefore could do nothing but stop it; the considerable crowd that had gathered before five o'clock saw nothing more than the exciting start of the participating motocycles and

locomobiles. They had not gone many hundred feet before the sight of a man in the road waving a red flag brought the vehicles to a halt, and a squad of blue-coats pouring out of a neighboring barn did the rest. Since the offenders had supposed that the race would be permitted they were let off with light fines. But this ends road-racing in Newton. Possibly there may be surreptitious races here and there on bits of road elsewhere, and brushes when the road is clear may be looked for on occasion. But should these ever get too common, legislative enactments making high speed impossible through requirements as to gearing would certainly be the next thing in order. Possibly special permits for road-racing might be obtained from the authorities should the occasion be deemed sufficient to warrant it. But since these permits are no longer granted for bicycle road-races, now that well equipped bicycle-tracks have become common, it is unlikely that the rule will be violated in behalf of the automobile wherever bicycle road-racing is forbidden. Automobile-racing has its proper place in sports, but that place is on enclosed courses, under conditions similar to those required for horse-racing. When French manufacturers complain that road-racing is essential to the encouragement of the industry they may be reminded that the exclusion of horses from open-road racing has not discouraged the breeding of swift horses, but the contrary.

It is interesting to note the way in which the International race became permitted in France. The government was firm in withholding its permission until the sentiment of the villages along the route began to assert itself in favor of such races, which bring crowds from the country all around to see the automobiles dash past and incidentally to spend money in the place. In the present state of the law the central government permits a road-race under certain conditions, but the local municipal councils along the route have the right to forbid the race from passing their way. This might give encouragement to local politicians to act an obstructive part until they had been properly "seen," and it was reported in some places that money had to be freely used before this race could be assured.

"The Moto"

Mr. Nathan Haskell Dole should be credited with scoring one in his suggestion of a popular name for the automobile. He recommended the adoption of the word "moto" as a terse and effective designation. Now, in the very cradle of the automo-

bile, where the word itself originated, a strong rival of the powerful Automobile Club de France has been organized and the name selected is the "Moto Club de France." So the new designation, applied under auspices specifically popular and democratic, promises to find vogue in France; and therefore, like the word "automobile," to become current in other parts of the world. "Moto" is a much better word than "auto," "mobe," or anything else that has been suggested, and since we must have a short name for popular use it will probably fill the bill better than anything else that has been suggested.

The Automobile as a Friend in Need

The automobile may have uses other than locomotory, as was shown recently in the little English village of Leatherhead, where an entertainment was given for the benefit of the wounded in the South African War. A feature was to be an exhibition of the cinemetograph. But the storage-battery that had been ordered from a neighboring city to supply the needed electric current of 25 amperes at 60 volts failed to appear, and it looked as if this part of the programme would have to be abandoned. But it happened that a gentleman living in the neighborhood owned an electric automobile and he offered the use of it for the purpose. So the vehicle made its own way into the hall, connections were effected with its accumulator and the cinemetograph was operated with thorough success.

Any automobile might be utilized to furnish power in case of emergency simply by jacking it up a little and attaching a belt to the motor. In certain instances it might be economy to utilize it regularly for such purposes when not in regular use. A farmer, for instance, might thus make it saw his wood, do his threshing, etc., and even run a dynamo at night to supply electric light.

A Rail-Track Course

It seems worth considering whether it would not be worth while, in connection with a race-course for automobiles, to include a railway course whereon might be tried not only steam locomotives, but electric and other forms of motors designed for railway use. By locating such a track near a railroad all sorts of locomotives might easily be brought to the place for trial. Such a feature would be a great novelty and sufficiently exciting to become a great attraction. A powerful locomotive "running

wild" is a very different thing from the same machine dragging a heavy train, and under these conditions an enormous speed might be attained.

The Automobile at Pleasure-Resorts

The automobile makes its appearance at White Mountain resorts this summer for the first time as a vehicle for public use. Mr. F. O. Stanley was at the mountains with his locomobile last summer and ascended Mount Washington, demonstrating the practicability of the automobile for mountain work. There is enough of fairly good road in the White Mountains to make the automobile really serviceable there even under present conditions. The introduction of mechanical traction will, moreover, be a powerful incentive for the construction of good roads, both as to grade and road-bed. Under existing circumstances an excellent automobile excursion can be made from Plymouth to Bethlehem, returning by way of the Intervale. A writer in the Boston *Herald* says:

"The hotel men generally feel that the automobiles would be a great improvement over the former method of touring, and they are planning on inaugurating the service. The first expense is, of course, a great drawback, but once in service, the machines would be cheaper to maintain than horses. One of the great problems of the mountain stables is as to the keep of the horses when not wanted for conveying summer visitors. A large number is required by each of the hotels, but when the season is over there is little use for them. The farmers want them at the same time the hotel visitors do, so that the horses cannot be let out, and accordingly they are a drug in the mountain market during the late fall, winter and early spring. To supply the demand the big hotel men have to keep on hand at all times a large supply and the problem is a difficult and expensive one. With automobiles it is different. They can be used in the cities almost any time, and even if not transferred are not eating their heads off when not in use, as the hotel men have found to their cost is the case with horses."

It may be added that, instead of transferring the vehicles to the cities, a still better field offers in transferring them to the winter resorts of the South, utilizing them in the autumn and the spring, say in Virginia and North Carolina, and such places as Lakewood, in New Jersey, while in the mid-winter season they would be in full demand in Florida, in Georgia, in Cali-

fornia, and even in island resorts like Bermuda, famous for its perfect roads. We shall probably, before many seasons pass, see this migratory idea in full operation.

The Question of Speed

"Road-races are suppressed, the true automobilism is going to begin," writes the French engineer, J. Ravel, in *La France Automobile*. "Everything has been sacrificed to that idea: the augmentation of speed without ceasing," he continues. "Think on how many lines of railway at present do they attain a speed of 80 kilometres, although the wheels of the locomotives and the cars are guided by the rails over a perfect way—and they strive to reach that speed on poor ways with no other guidance than the address or the *sang froid* of a driver!" M. Ravel says that the constructors, instead of devoting themselves to perfecting their motors and their transmitting mechanism, confine themselves to one problem—and what a problem! The augmentation of power in the motor, talking of nothing but maintaining 12, 16, 24 and 30 horse-power; and while augmenting their power they neglect to augment correspondingly the strength of active and supporting parts. He holds that even a speed of 25 kilometres (over 16½ miles) an hour is altogether too high for ordinary purposes. A speed of 25 kilometres is equivalent to a speed of about 7 metres a second. And in passing along a road a distraction, or a cramp that means but a second of pain, is sufficient to throw the persons in the vehicle into the ditch to the right or the left. Returning to road-racing, M. Ravel asserts that it is absolutely useless; it always has been, and it is, of more harm than good to the cause of automobilism. Already, in 1896, he advocated in *La France Automobile* the suppression of road-racing and the interdiction of high speed. At that time M. G. Pierron, the Vice-President of the Touring-Club of France, agreed that road-races were demoralizing the public, and particularly the amateurs. And the Count de Dion then held that a maximum of 22 to 23 kilometres was more than sufficient for the public. But the latter advocated road-racing as necessary to the proper development of the automobile. As to this, M. Ravel holds just the contrary to be true; that road-racing has impeded progress by hypnotizing manufacturers with speed.

The Automobile Index

Everything of permanent value published in the technical press of the world devoted to any branch of automobile industry will be found indexed in this department. Whenever it is possible a descriptive summary indicating the character and purpose of the leading articles of current automobile literature will be given, with the titles and dates of the publications.

Accumulators—

Competitive Tests of Accumulators. An account of the competitive tests made by the Automobile Club of France, from June 3 to December 2, 1899, with a table showing results. "Elektrochem Zeitschr," May, 1900.

A technical article regarding the methods employed for the transport of acetylene in reduced volume (from "Echo des Mines"). "The Horseless Age," New York, June 20, 1900.

Acetylene and its Adaptability as a Motive Power for Vehicles—

A technical article by E. C. Oliver. "The Horseless Age," New York, June 20, 1900.

Acetylene Generators for Motor Vehicles—

A detailed technical article by W. F. Cooper. "The Horseless Age," New York, June 20, 1900.

Acetylene Motors—

A technical article regarding the question of the employment of acetylene for motive power. The author, Henri Cuinat, states that the development of all the applications of acetylene—to lighting, to heating and to motors—is arrested by the cost of the carbide. When the electrochemists furnish the industry with carbide at 250 to 300 francs, the days of coal gas will be numbered (from "Journal de l'Electrolyse"). "The Horseless Age," New York, June 20, 1900.

Automobiles—

A description of an electric vehicle of recent European introduction. "The Motor Vehicle Review," Cleveland, July 3, 1900.

A description of the new four-seat Blake gasoline carriage. With one illustration. "The Motor Car Journal," London, June 30, 1900.

A description of a new six horsepower wagonette of recent European introduction. "The Motor-Car Journal," London, June 30, 1900.

A detailed technical description of a new carriage of European manufacture. With eight illustrations. "Cyle and Automobile Industriels," Paris, July 1, 1900.

The automobile wagon for heavy duty. By Arthur Herschmann. Describing the conditions which make these vehicles most desirable, considering the construction, propulsion, etc. Illustrated. American Society of Mechanical Engineers, May, 1900.

Automobile Fire-engine—

A brief account of an auto-cycle chemical fire-engine of American manufacture. With one illustration. "Cycle and Automobile Trade Journal," Philadelphia, July 1, 1900.

Automobile Gun Carriage—

A brief description of a motor-tricycle and gun carriage manufactured in Europe for the Norwegian Government. With one illustration. "The Motor-Car Journal," London, June 23, 1900.

Bicycle Motors—

A technical description of the Holley motor. With one illustration. "The Automobile Review," Chicago, June, 1900.

A technical description of an improved four-cycle gasoline motor of American manufacture. With one illustration. "The Motor Vehicle Review," Cleveland, July, 1900.

Carbureter—

A brief technical account of a new auto-carbureter of American manufacture, which is said to be affected neither by the varying degrees of temperature nor the dampness of the atmosphere. With one illustration. "The Motor Age," Chicago, July 5, 1900.

Combination Systems—

Combination systems. Description, with two illustrations, of these systems, with remarks on their advantages and disadvantages. "Horseless Age," New York, May 9, 1900.

Cylinder Head—

A description of a new water-cooled cylinder head designed for a well-known automobile motor. With two illustrations. "The Autocar," Coventry, June 30, 1900.

Economical Laws of the Progress of Automobilism—

A popular article exploiting the possibilities of the new industry. "Automobile," Berlin, May 26, 1900.

Electric Carriage—

A technical description of the new Kühlstein electric carriage, possessing some novel features. With four illustrations. "The Autocar," London, June 23, 1900.

Electric Automobile—

A brief account of the new Century Electric Automobile. With one illustration. "The Automobile Review," Chicago, June, 1900.

Employment of Aluminium in the Construction of Automobiles—

A technical article (from "Journal de l'Electrolyse"). "The Horseless Age," New York, June 13, 1900.

Engine—

A description of the Simms vertical water-cooled engine. With one illustration. "The Autocar," Coventry, June 30, 1900.

Friction Clutch—

A technical description of a new simple and practical friction clutch of American manufacture. With two illustrations. "The Horseless Age," New York, June 13, 1900.

Gasoline Motor Cycles—

A detailed technical description of the Comiot-Eadie Motocycles and Cycles, by I. Lainé. With three illustrations. "Cycle et Automobile Industriels," Paris, June 17, 1900.

Horse-power Tests of Automobiles—

A detailed technical article on the subject. With four illustrations. "The Motor-Car Journal," London, June 9, 1900.

Hydro-Carbon Automobiles—

The Georges Richard Voiture. Illustrated description of the latest type. Condensed from "La France Automobile." "Horseless Age," New York, May 16, 1900.

A technical description of the new Tourand carriage. With nine illustrations. "La Locomotion Automobile," Paris, June 7, 1900.

A technical description of the "L. Linon" Motor cars, by José Md. Monmany. With one illustration. "El Automovilismo Ilustrado," Barcelona, June 15, 1900.

A brief account of the imperial gasoline carriage. With one illustration. "The Automobile Review," Chicago, June, 1900.

A description of the Packard gasoline carriage. Illustrated. "The Horseless Age," New York, May 16, 1900.

Hydro-Carbon Motors—

A brief technical description of the new Lukas-Villian motor. With three illustrations. "Automobile," Berlin, June 10, 1900.

A detailed technical description of the Keystone gasoline motors for vehicles and launches of the four-cycle, inclosed crank-case type. With one illustration. "The Motor Vehicle Review," Cleveland, O., June 19, 1900.

Ignition—

From the Batteries to the Sparking Points. An article by Reginald P. Wales. "The Automobile Review," Chicago, June, 1900.

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Illumination—

A brief description of a new searchlight of American manufacture, by the light of which it is claimed a watch can be read at the distance of a quarter of a mile. With one illustration. "The Motor Age," Chicago, July 5, 1900.

Liquid Fuel Motors—

Liquid fuel motors for vehicles. By Hugo Güldner. A fully illustrated account of many types of liquid fuel motors. Serial. 1st part. "Zeitschr d Ver Deutscher Ingenieur," Berlin, April 28, 1900.

Lubrication—

The lubrication of motor vehicles and cycles. Information from a pamphlet written by J. Veitch Wilson. "Automotor Journal" London, May 17, 1900.

Some valuable and concise remarks on the question of lubricating. By J. W. Wilson, London. "The Automobile Review," Chicago, June, 1900.

Lubrication of Motor Tricycles—

Advices and rules to prospective purchasers. By Arthur Goodwin. "The Motor-Car World," London, June, 1900.

Mechanical Propulsion—

Road locomotion. By H. S. Hele-Shaw, with appendices by experts. Discusses the general principles of the engineering features of the question; the behavior of the wheel upon the road, steering and turning, motive power and transmission, etc. Illustrated. "Institute of Mechanical Engineers."

Mixture and Carburation—

A technical article. "Cycle et Automobile Industriels," Paris, June 10, 1900.

Model Automobile Barn—

A detailed description of a recently completed "Automobile Stable" in Cleveland, O., with charging stations, gasoline tanks, pumps, repair tools and other accessories. With one illustration. "The Motor Age," Chicago, July 5, 1900.

Motor Cycle Mysteries—

A number of facts regarding unexpected accidents to cycle motors. By A. J. Wilson. "The Autocar," London, June 9, 1900.

Motor—

A technical description of the Mounier-May motor. With two illustrations. "La Locomotion Automobile," Paris, June 21, 1900.

Motor Bicycles—

A technical description of the Werner motor bicycle. With two illustrations. "The Motor Vehicle Review," Cleveland, June 12, 1900.

A detailed technical description of the new motobicycle, "la Constantin." With four illustrations. "L'Industrie Velocipédique and Automobile," Paris, June 25, 1900.

A brief account of a new motocycle of European manufacture. A motor supported directly over the rear wheel. With one illustration. "The Autocar," London, June 16, 1900.

New System of Setting up Spokes of Tension Wheels—

Technical description of the new King system. With five illustrations. "La Locomotion Automobile," Paris, May 24, 1900.

Opposing Automobile Racing—

An article by T. Ravel, for the suppression of races. The author declares that Automobilism is being developed on false lines, as at present it tends simply toward increase of speed. "La France Automobile," Paris, April 29, 1900.

Pneumatic Tires—

The manufacture of a pneumatic tire. From "La Nature." Illustrated detailed description with related information. "Scientific American" Supplement, New York, May 12, 1900.

Racing Machines—

A technical description of an Austrian racing machine which won first prize in the Turbil (mountain) race, attaining speed of ninety-two kilometres on the level and twenty-five

kilometres on twelve per cent. grade. With two illustrations. "The Motor-Car Journal," London, June 16, 1900.

A brief description of the new Benz racing car. With one illustration. "The Autocar," London, June 16, 1900.

Safety Valve—

A brief description of a new device of American manufacture designed for gasoline motors. With one illustration. "The Motor Age," Chicago, June 14, 1900.

Some French Experiments with Acetylene and Alcohol as Motor Fuels—

A technical article by P. M. Heldt, comparing the prices of gasoline, calcium carbide and alcohol in the United States. "The Horseless Age," New York, June 20, 1900.

Some Properties of Acetylene—

A detailed technical article by Herbert L. Towle. "The Horseless Age," New York, June 20, 1900.

Speed Change—

A detailed technical account of a new speed-changing system, said to present many novel features. With two illustrations. "La Locomotion Automobile," Paris, June 28, 1900.

Spur Gear Differential—

A technical article by T. B. Chamberlain. With one illustration. "The Automobile Review," Chicago, June, 1900.

Steering—

The pivot steering gear in practice. P. M. Heldt. Illustrated description. "Horseless Age," New York, May 2, 1900.

Storage Batteries—

The selection of a storage battery for an automobile. Giving a method for determining the speed and radius of the vehicle, illustrating by working out the problem for a given vehicle. "American Electrician," New York, June, 1900.

Testing—

Formulæ for designing and testing automobiles. By Dr. Walter Kummer. Theoretical discussion of the determination of the efficiency of self-propelling vehicles. "Elektrotech Zeitschr," May 3, 1900.

The Automobile for Heavy Duty—

Extracts from a paper read before the American Society of Mechanical Engineers, Cincinnati, May, 1900. "The Horseless Age," New York, June 13, 1900.

The Automobile in War—

Some interesting points on the subject brought out by a paper read before the Automobile Club of Great Britain, by the Rt. Hon. J. H. A. Macdonald, who states that anything which tends to increase the speed of an army from place to place and enables it to withdraw from the railroad is destined to be of the highest value, and this is where the modern automobile should come in and take the place of animal traction and the traction engine, which has been used to some extent already. "The Automobile Review," Chicago, June, 1900.

The Motor-Vehicle for Heavy Duty—

Extracts from a paper read at the Cincinnati meeting (May, 1900) of the American Society of Mechanical Engineers, by Arthur Herschmann. "The Motor Age," New York, June 21, 1900.

The New Mors Racing Car—

A brief account regarding the new Mors racing car. With one illustration. "The Motor-Car Journal," London, June 9, 1900.

The 1,000-Mile Trial in England—

Its lessons and knowledge derived therefrom. A technical article. "The Motor-Car Journal," London, June, 1900.

The Trend of Progress of the Automobile—

Second paper of a serial. By R. H. Thurston. "The Automobile Magazine, New York, July, 1900.

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Trials—

The Automobile Club's 1,000-mile trial. A general account of the vehicles completing the run and of their performance. "Engineer," London, May 18, 1900.

The 1,000-mile trial of the Automobile Club of Great Britain and Ireland. An account of the vehicles, hill-climbing records and speed trials. "Automotor Journal," May 17, 1900.

Two-seated Tricycle—

A brief account of a new two-seated tricycle of European manufacture. With one illustration. "The Autocar," London, June 23, 1900.

Two-stroke Gasoline Motor—

A technical article regarding the "explosion-every-revolution" motor. The author considers the advantages which might be obtained by its use and the difficulties which at present restrict its employment. From the "Automotor Journal," Chicago, July 5, 1900.

Voiturettes—

A description of a new light carriage of French design. With one illustration. "The Motor-Car Journal," London, June 30, 1900.

A detailed technical description of the "Victoria Combination" of European manufacture. With one illustration. "Cycle et Automobile Industriels," Paris, June 24, 1900.

A technical description of the new "Westchester County Model." With one illustration. "Cycle and Automobile Trade Journal," New York, July 1, 1900.

A brief technical description of a new two-seat light carriage of European manufacture. With one illustration. "The Motor-Car Journal," London, June 23, 1900.

A brief technical description of the Loutzky voiturette. With three illustrations. "The Autocar," London, June 9, 1900.

A brief description of the Wilford petroleum spirit motor voiturette. With one illustration. "The Motor-Car Journal," London, June 9, 1900.

A description of a light vehicle of European invention. With one illustration. "The Motor-Car Journal," London, May 26, 1900.

A description of a light gasoline carriage of European manufacture. With two illustrations. "The Automotor Journal," London, May, 1900.

A technical description of a light carriage recently introduced in Europe. With four illustrations. "The Automobile Magazine," June, 1900.

Wagonette—

A description of a new vehicle of European manufacture, designed for public service. With one illustration. "The Motor-Car Journal," London, May 4, 1900.

Water-circulating Pump—

A description of a new water-circulating pump for automobiles. With two illustrations. "The Motor-Car Journal," London, May 12, 1900.

Water Cooling Tube—

Description of a French invention, designed for gasoline motors. With one illustration. "The Motor Age," Chicago, April 26, 1900.

Water-cooling Coil—

The Apprin water-cooling coil described and illustrated. "The Motor-Car Journal," London, February 2, 1900.

A brief description of a new cooling device of European introduction. "The Motor-Car Journal," London, June 23, 1900.

Weight—

The Tare Weight of Motor Vehicles. H. Wilcke. Letter to the editor reviewing the leading points connected with this matter from an English point of view. "Engineering," January 12, 1900.

Wheelman and Automobilist—

An editorial opinion by The "Sun" with footnote. "The Automobile Magazine," May, 1900.

Wheels—

"Construction and Function of Motor-car Wheels." A technical article by A. J. Wallis-Tayler, C. E. With illustrations. "The Motor-Car World," London, March, 1900.

The Esty motor vehicle wheel described and illustrated. "The Horseless Age," March 14, 1900.

Dished wheels. By H. E. Wimperis. Considering their advantages and disadvantages when applied to automobiles. "The Automotor Journal," London, February, 1900.

Will Acetylene be the Coming Power for Motor Vehicles?—

An article by D. N. Long. "The Horseless Age," New York, June 20, 1900.